

U.S. Marine Corps



**LOCAL AND WIDE
AREA NETWORKS**



DEPARTMENT OF THE NAVY
HEADQUARTERS UNITED STATES MARINE CORPS
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GUIDELINES FOR LOCAL AND WIDE AREA NETWORKS

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1. PURPOSE. To provide guidance on the planning, acquisition, development, management, and use of Local Area Networks (LANs) and Wide Area Networks (WANs).
2. AUTHORITY. The information promulgated in this publication is based on policy and guidance contained in the reference.
3. APPLICABILITY. The guidance contained in the enclosure is applicable to all Marine Corps personnel responsible for the planning, acquisition, development, management, and use of LANs and WANs. This guidance is applicable to the Marine Corps Reserve.
4. DISTRIBUTION. This technical publication will be distributed as indicated.
5. SCOPE
 - a. Compliance. Compliance with the provisions of this publication is required unless a specific waiver is authorized.
 - b. Waivers. Waivers to the provisions of this publication will be authorized only by CMC (MCCTA) on a case by case basis.
6. RECOMMENDATIONS. Recommendations concerning the contents of this technical publication should be forwarded to CMC (MCCTA) via the approved chain of command. All recommended changes will be reviewed upon receipt and implemented if appropriate.
7. SPONSOR. The sponsor of this technical publication is CMC (MCCTA).

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Information Resources Management (IRM) Standards
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Chapter 1

INTRODUCTION

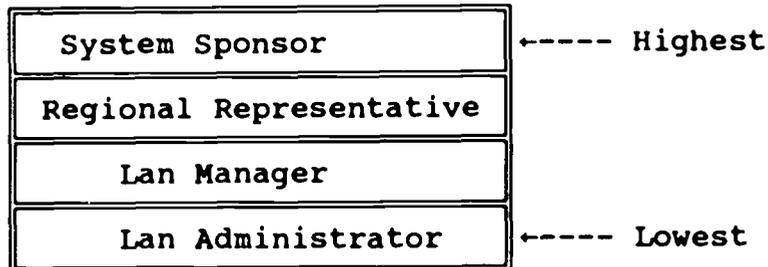
1.1. PURPOSE. This Technical Publication is intended primarily to aid personnel who are planning the acquisition, development, installation, management and use of Local Area and Wide Area Networks (LANs and WANs).

1.2. BACKGROUND. As the number of Local Area Networks (LANs) has grown Marine Corps-wide, it has become necessary to standardize the operating system that will be used, as well as the components, topologies, and configurations that make up a network. Compliance with this Technical Publication will enhance the performance of your LAN and minimize any problems that may occur during the installation or management of your network. Prior to November 1989 there were no standards established for local area networks. Prior to that date, a decentralized procurement policy allowed the proliferation of LAN and Network Operating System (NOS) types within the Marine Corps. Following a review of requirements during the March, 1989 meeting of the End User Computing and Local Area Network (EUC/LAN) Working Group, the Marine Corps standardized on Banyan VINES as the Marine Corps-wide network operating system. Its global naming convention, ease of installation and maintenance, and Wide Area Network (WAN) support were just a few of the reasons for its selection.

1.2.1. Support. The first step towards standardization was the appointment of a system sponsor for Network Operating Systems (NOS) in February of 1990. The mission of the system sponsor is to improve service of the networks through uniform technical configuration and maintenance upgrades. The system sponsor also coordinates and monitors troubleshooting efforts through the use of a 4-tier support system: The Banyan Network Support System. (MARCORCOMTELECT message 240830 JAN 92 refers.) At present, this duty is performed by the Marine Corps Central Design and Programming Activity (MCCDPA), Quantico, VA.

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1.2.2. System Sponsor. The System Sponsor (MCCDPA Quantico) will be the highest echelon in the support ladder. The system sponsor will train appropriate technical personnel on the inner workings of the standard NOS. With Banyan education and available assets, these technicians should be able to answer most, if not all, problems addressed to them. In addition, the system sponsor will have direct liaison with vendor technicians on all technical matters that they can not resolve themselves.

1.2.3. Regional Representatives. The Marine Corps has been divided into regional areas to provide a convenient breakdown of network support responsibilities. These regional areas are divided along support lines instead of strictly geographical locations. The intent is to provide support to commands even in the event of a deployment; hence focus on Fleet Marine Force (FMF) structure. These sites will be staffed with individuals who will be school trained technicians capable of handling the majority of problems arising in their regions of responsibility. If a problem arises that they are unable to resolve, they will forward it to the system sponsor. (See Appendix E for a list of current representatives.)

1.2.4. Local Area Network (LAN) Manager. LAN Manager's will act as the second level of support in the network management environment. They will be responsible for the day-to-day operation of the LAN, and will be trained to ensure optimal operation of the network. They will be able to answer many questions posed to them from LAN Administrators as well as the supported command. Any questions or problems arising that they are unable to answer will be forwarded to the Regional Representative.

1.2.5. Local Area Network (LAN) Administrator. This is the first level of support. The LAN Administrator position is typically assigned to a Marine within a single functional area (e.g., SJA, S-1, S-4). Because the LAN Administrator is the closest level of support to the end user, his/her job is critical and time sensitive. The LAN Administrator Serves as the primary point of contact for all issues pertaining to the LAN.

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1.3. OPEN SYSTEMS INTERCONNECTION (OSI). In an attempt to standardize the data communication industry, various vendors have adopted the International Standards Organization's (ISO) layered approach (commonly known as the OSI Reference Model). The primary objective of this concept is to provide a common basis for the coordination of standards development for the purpose of open systems interconnection, while allowing existing standards to be placed into perspective within the overall reference model. In the reference model, system specifications are not outlined, nor are there definitions of the specific services and protocols to support the interconnection architecture. Instead, the reference model is meant to serve as a conceptual and functional framework which permits the independent development of standards for each of the functional layers. OSI defines seven distinct layers which relate to seven different interface requirements. These layers range from the lowest interface requirement which specifies physical connections, to the highest interface requirement which specifies user to application connections (called sessions). The OSI defines a system as a set of one or more computers, the associated software, peripherals, terminals, human operators, physical processes, information transfer means, etc., that forms an autonomous entity capable of performing information processing or information transfer. An open system is one which obeys OSI standards in its communication with other systems. Essentially, the OSI Reference Model specifies that it does not matter what or how things are performed within each layer as long as the interface between the layers is standard and strictly adhered to by all participants. Following this methodology, vendors and users can modify or replace a layer (or module) to obtain added capabilities without having to replace anything else (as long as the interface between the layers and modules remains the same). The standards contained within this document conform, to the maximum extent practical, to the OSI Reference Model.

1.4. ASSUMPTIONS AND CONSTRAINTS.

1.4.1. ASSUMPTIONS. In developing these standards, the following assumptions were made:

a. No single Local Area Network (LAN) design can meet the various requirements of different Marine Corps organizations.

b. No single network can meet the requirements of a base-wide communications network and at the same time provide all the services required by all the organizations served.

c. All LANs have a high probability of eventually requiring inter-LAN communications. It is more cost effective to include this communications capability in network specifications from the start than to attempt to include it later as an "add on."

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d. The information system (IS) and communications fields do not have enough personnel available for day-to-day support of LANs. Therefore, end users must maintain and operate their LANs using organic assets.

1.4.2. Constraints. In developing these standards, the existing and planned Marine Corps inventory of hardware, software, manpower, and facilities were taken into account.

1.5. DEFINITIONS. The standards contained within primarily address the interface between data communication "entities". To fully understand this approach, it is necessary to briefly describe these entities and their relationships.

1.5.1. Marine Corps Data Network (MCDN). MCDN is a common-user data communications network that provides terminal-to-computer and computer-to-computer communications throughout the Marine Corps. This network is based upon IBM's System Network Architecture (SNA) and uses IBM's protocol, Synchronous Data Link Control (SDLC). Any connections to MCDN must adhere to this architecture and its associated protocol without exception. The interface requirements for this architecture are well documented and accepted in industry and government. It is envisioned that the Marine Corps will take advantage of new technology which is introduced and supported within SNA.

1.5.2. Defense Data Network (DDN). DDN is a Department of Defense (DoD) sponsored packet switching network designed to provide worldwide data communication connectivity for DoD activities and agencies. This network is based upon the X.25 protocol which is an accepted international standard. Eventually, the Marine Corps will use this network to provide communication trunks between the various Marine Corps installations. In this environment, DDN will be transparent to users of MCDN. Users requiring access to a major Marine Corps' host computer system will do so via SNA. In addition to the communication services provided for large computers, DDN also has a wide variety of services available for other types of devices.

1.5.3. Network. A Network can be defined as a group of computer devices connected by a communication channel. The intent of a network is to support data communications and to enhance the personal computer's (PC) stand alone capabilities by allowing the PC to share data and equipment which may not be locally available.

1.5.4. Local Area Networks (LAN). Typically, LANs are installed within the confines of an office space, or building(s). The emphasis of the LAN standards is to define the gateways, bridges, and physical interface requirements to access other LANs, devices, or Marine Corps mainframe or host computers. To the Wide Area Network (WAN, described below) and MCDN, these LANs appear as a single entity with access via well defined paths.

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1.5.5. Wide Area Networks (WAN). A WAN is analogous to what the private sector calls an enterprise network.

a. WANs will provide local connectivity aboard a base, station, or Amphibious Operation Area (AOA). It is anticipated that these WANs will ultimately allow for interconnection of all Marine Corps LANs using MCDN trunks or switched and broadcast tactical networks as the backbone, exclusive of front-end processors and mainframe gateways. It is not the intention of this document to specify what type of communication media or services will be provided, but rather to ensure that the interface is compatible.

b. The major characteristic of a WAN which distinguishes it from a LAN is that a WAN is a common-user network providing inter-organizational communications. These standards neither assume nor require the installation of WANs. However, these standards do assume that the primary function of WANs is to provide data communications, not to provide value-added features such as printer and file servers, E-mail, etc. These services should be provided by LANs.

1.5.6. Stand-alone Devices. Those devices which are not part of a local area network but which require connectivity (normally to a Marine Corps host computer). These devices may be supported by a WAN (future connectivity may be provided by DDN). Some examples of these types of devices are:

a. Small minicomputers (System/36, System/38, Series/1, VAX 11/780, NBI S/64, Wang OIS, etc.).

b. Multi-user systems with workstations.

c. Stand-alone PCs not attached to a local area network.

d. Universally shared servers.

e. Other value added features providing shared functions.

1.6. LIFE CYCLE MANAGEMENT. All local and wide area networks will be developed and procured following Life Cycle Management (LCM) principles. LCM is a common sense process used to obtain, develop, and administer automated information systems over their entire life with emphasis on strengthening early decisions which influence costs and utility. Policy and guidance concerning this process is published in MCO P5231.1.

1.7. SUMMARY. This document was developed with the purpose of providing a step by step procedure on how to plan, develop, and maintain a local area network. It also outlines the support mechanism in place. The goal is to provide the Marine tasked with setting up or maintaining a local area network with the tools to accomplish his/her mission.

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Chapter 2

RESPONSIBILITIES

2.1. INTRODUCTION. This chapter outlines the functions performed by various Marine Corps supervisory levels. For more detailed information on the LAN and LAN Administrators, refer to Chapter 8 (Network Management).

2.2. UNIT COMMANDER. The unit commander's responsibility with regard to LAN installation begins with the commanders approval of the LAN requirement. The commander must also determine the operational use of the LAN such as whether personal messages may be transmitted, if LAN traffic constitutes official mail, as designated by HQMC, and the designation of authorized users. The commander is also responsible for ensuring that personnel appointments are effected and that their level of training is maintained. The commander is specifically responsible for appointing an Information System Coordinator (ISC), a LAN Manager, and a LAN Administrator.

2.3. SYSTEM SPONSOR. The Marine Corps Central Design and Programming Activity (MCCDPA) Quantico, Virginia is currently assigned as the systems sponsor for the standard network operating system.

2.3.1 Duties and Responsibilities. The System Sponsor has the following duties and responsibilities.

a. Serve as the Marine Corps liaison with the NOS vendor on all technical matters.

b. Provide guidance to the Regional Network Support Representatives to ensure that networking standards are enforced throughout the Marine Corps.

c. Coordinate training for the Regional Network Support Representatives.

2.4. REGIONAL REPRESENTATIVES.

2.4.1. Duties and Responsibilities. The Regional Network Support Representatives will have the following duties and responsibilities.

a. They are responsible for all the LANs within their region.

b. They work with the system sponsor to provide a standard network throughout the Marine Corps.

c. They provide guidance to the LAN Managers, LAN Administrators, and Users within their region.

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d. They assist local LAN Managers with planning, cabling, and management of the LAN Manager's LAN.

e. They coordinate administrator training for the Network and LAN Administrators within their region.

2.5. ADMINISTRATION. Listed below are typical responsibilities of the LAN Manager, LAN Administrator, and the User.

2.5.1 LAN Managers. The LAN Manager is normally assigned by the command organization responsible for the installation and implementation of the LAN equipment. The LAN Manager may be responsible for a single network server, or a complex network consisting of several servers connected by a backbone network. Some of the LAN Manager's responsibilities are listed below.

a. The LAN Manager is the commander's appointed OIC/SNCOIC/NCOIC of the LAN. As such, the LAN Manager enforces command intent with regard to LAN operations.

b. The LAN Manager is responsible for configuration management, naming conventions, and hardware/software configuration in accordance with this publication.

c. The LAN Manager is responsible for enforcing local security measures, to include the physical security of the servers and information security for sensitive data.

d. The LAN Manager is the first person to become involved in LAN planning. He/she will work with the Regional Network Support Representative to ensure that the command's LAN fits into the region's WAN.

e. The LAN Manager is responsible for the installation, configuration, and documentation of the network.

f. The LAN Manager will coordinate the network training, that is provided by the Regional Support Representative, for the LAN Administrators and users on his/her network.

g. The LAN Manager acts as the primary point of contact for all LAN Administrators on his/her LAN.

h. The LAN Manager assists the Regional Representatives with upgrading the network with patches and utilities, as required.

2.5.2. LAN Administrators. A LAN Administrator is typically assigned for each group within the network's organization. For example: 2ND MARDIV is the network organization with groups consisting of G-1, G-2, G-3, ... etc. A LAN Administrator would normally be assigned for each group. The LAN Administrator is subordinate to the LAN Manager and is directly responsible for

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implementation of local instructions. Normally part of the same organization as the LAN Manager, the LAN Administrator can either assist in managing the same LAN or a smaller, designated portion of the LAN. This includes password administration, restricting access levels and managing the addition and deletion of users.

a. LAN Administrators are typically responsible for the operational management of the LAN. This includes server operations, network monitoring, backup procedures, problem resolution and maintenance.

b. The LAN Administrator will normally add new users to the network, build the respective profiles, establish nicknames, allocate services, and assign appropriate access rights.

c. The LAN Administrator typically maintains local LAN records for his/her group and reports activities to the LAN Manager. (Refer to Chapter 7 for LAN documentation.)

d. In most cases, the LAN Administrator serves as the primary point of contact for all the users within his/her group.

e. The LAN Administrator is responsible for the security of any servers that are not shared by another group.

f. The LAN Administrator is normally held responsible for ensuring that the user's PCs are properly configured (autoexec.bat and config.sys).

g. The LAN Administrator will monitor the services allocated to his/her group.

2.5.3. Users.

a. The LAN user is responsible for compliance with security restrictions to include protecting the confidentiality of his/her password.

b. The LAN user is responsible for general maintenance and safeguarding of terminal equipment.

c. The LAN user will consult with the LAN Administrator on any technical questions, LAN problems and maintenance above the first echelon of repair.

d. The LAN user will identify training requirements to the LAN Administrator.

2.6. INFORMATION SYSTEM MANAGEMENT OFFICER (ISMO). Most FMF commands are supported directly by an ISMO. The ISMO can additionally be tasked as either the LAN Manager or LAN Administrator for his/her command.

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2.6.1. Duties. The ISMO is the primary staff officer for information resource matters within an FMF command. This is true whether the FMF unit is in or out of the garrison environment. The ISMO's functions include:

a. Advising the commander and his/her staff on information technology matters.

b. Acting as the command focal point on all matters pertaining to coordination of information technology requirements, objectives, concepts, plans, and policies, including establishing priorities with supporting and external data processing activities.

c. Exercise staff supervision of organic data processing units and equipment. This includes the command's LAN.

d. Preparing IRM support estimates, operating and contingency plans.

2.6.2. Planning. The ISMO will likely become involved in LAN planning. Consequently, the range of responsibilities include everything from budgeting and procurement, management, and security to field employment. Local Standard Operating Procedures (SOPs) should address the following topics:

Budgeting	Maintenance
Procurement	Documentation
Deployment Duties	Training
Site Configuration	Policy/Procedures
Functional Requirements	Security
Implementation	Administration
Field Employment	Tactical Interface

2.6.3. Deployed Support. Operational plans will normally include contingency planning for deployed network support throughout the entire MAGTF.

2.6.4. Training Support. Network users and LAN Administrators will receive training coordinated through the Regional Networking Support Representative. However, the ISMO should be prepared to augment training during deployments.

2.7. ADDITIONAL RESPONSIBILITIES. Other areas of responsibility lie with the local Functional Manager, Regional Automated Services Center Directors, the G-6 Officer, Headquarters Marine Corps, and the Marine Corps Systems Command (MARCOMSYSCOM).

2.7.1. Local Functional Managers. Local Functional Managers are responsible for coordinating information requirements that fall within the purview of the HQMC Functional Manager. This may include information that resides on several geographically

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separated LAN servers.

2.7.2. Regional Automated Services Centers (RASC) Directors.

RASC Directors normally provide Marine Corps Data Network connectivity. When deployed, this function is normally provided by the Forced Service Support Group. Within locally established guidelines, Directors typically provide access to local host computer databases and help coordinate regional training for LAN Managers. Directors also provide regional guidance and coordination concerning LAN planning and configuration.

2.7.3. G-6 Officers. The G-6 is responsible for providing the physical connection for all data circuits, circuit conditioning and managing the transmission quality of the data circuits. The G-6 will also coordinate with and assist the LAN Managers and the RASC (FSSG when deployed) during problem isolation and problem resolution where data circuits are involved.

2.7.4. Headquarters Marine Corps. The Director, Command, Control, Communications and Computer (C4) Systems Division is responsible for centralized policy formation, technical direction and acquisition of commercial ADP equipment, and interoperability policy. This division is responsible for management of the Marine Corps Data Network (MCDN).

2.7.5. Marine Corps Systems Command. In accordance with MCO 3093.1C, Marine Corps Systems Command (MARCORSYSCOM) is responsible for acquisition of tactical C4I systems and for defining technical intraoperability standards. MARCORSYSCOM is further assigned responsibility for cataloging and describing approved Marine Corps intraoperability standards for messages, data elements, and communications protocols in the Marine Tactical Systems (MTS) Technical interface Design Plan (TIDP).

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Chapter 3

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3.1. LAN Components.

3.1.1. Communications Channel. Each LAN workstation is attached to a communications channel, which is utilized to send and receive information. One example of a communications channel is the lines connecting two remote telephones. The telephone users can communicate (share information) with each other through the lines. Today, the most commonly used communications channel to connect LAN workstations is cable. There are various types of cable available that are supported by industry LAN standard bodies. The Institute of Electrical and Electronics Engineers (IEEE) Project 802 is one such body. Although the different types of cable or topologies are usually transparent to the user, there are many planning factors for the LAN Manager to consider as to which cable to use. These factors include, but are not limited to, speed, cost, distance, reliability and ease of installation. The important thing to remember is that a LAN workstation must be attached to a communication channel (i.e. cable, radio link), which is physically connected to a circuit board in the PC.

3.1.2. Network Interface Card. PC's are normally attached to a LAN through a circuit board called a network interface card (NIC) or network adapter. Some LAPTOP computers use an external adapter which, in effect, is a NIC. The NIC is installed into the PC and the network cable is attached to the connector on the NIC. The most common NICs used by the Marine Corps are for Ethernet, Token Ring, and Arcnet cabling systems. The type of NIC installed in a PC is dependent on network design or topology. The type of topology, cabling system, and workstation are the deciding factors in selecting the NIC. NICs are also available for 8 and 16-bit slotted PCs and Micro Channel workstations/file servers.

3.1.3. Server. LANs use special computers called file servers to manage the shared resources on the network. A PC or a computer designed especially for use as a server may be used. Every LAN must have a file server, which is usually a computer that uses the 80386 or 80486-class processor. It can also be vendor specific such as a Banyan Corporate Network Server (CNS). File servers are similar to host computers such as a mainframe. The primary difference is that in a host environment, all processing takes place at the host. In a Network environment, processing is distributed throughout the network. In other words, whereas host computers hold all the programs and data that a user accesses, a network's shared resources reside in the file server itself AND the workstations connected to the LAN. The server controls the sharing of this information between LAN devices.

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a. File Server Components. The file server generally consists of a mass storage device, one or more NICs, printer ports, and communication ports. The mass storage device consists of at least one large disk drive capable of holding the operating system and files to be shared by users on the network. One or more NICs are installed in the server to connect LAN cable segments. Printer ports are used to connect shared printers, while communication ports are used to communicate with other servers or networks. Today, file servers are connected to PCs through the cable. Future LANs will likely use radio/infrared (wireless) links.

b. Server Functions. The file server manages the shared hard disk and ensures that requests to its disk(s) do not conflict with each other. File servers also keep track of who is authorized or unauthorized to access what data.

3.1.4. Network Operating System (NOS). A NOS is a control program that resides on a server within a LAN. The NOS is vendor software that is loaded on a particular server. It manages resources that are shared by more than one computer. For example, several users can use a disk drive on a file server as well as all printers connected to that server. The NOS on the server communicates through the NIC and cable to the operating system on the workstation, routing information back and forth.

3.2. Topology. The design and layout of a LAN is called the topology. There are two types of topologies, physical and logical. Physical topology is the physical layout or arrangement of the devices (Nodes) and links that make up a network. Logical topology is the description of the possible logical connection between network nodes, indicating which pair of nodes are able to communicate, whether-or-not they have direct physical connection. The three commonly used physical topologies in the Marine Corps are bus, star, and ring.

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3.2.1. Bus Topology. A bus or linear-bus is a simple design with a single length of cable, known as a bus or trunk. All devices on the LAN are attached to the bus and share this single communications medium (see Figure 3-1). The bus topology is simple and very economical. In a bus topology, the main cable (bus) must pass by each networked device, which is not the case in all topologies. Since all devices share the bus, the cost of cabling may be lower than other topologies because only one cable is used. The failure of any networked device does not have an effect on the rest of the network. However, cable failure can bring down the entire network.

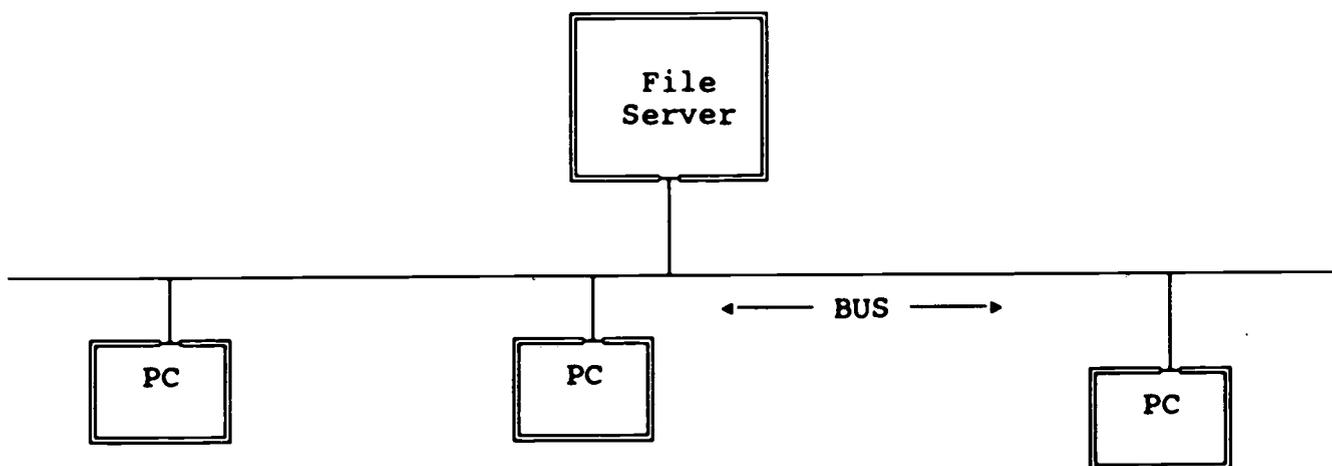


Figure 3-01
LINEAR-BUS TOPOLOGY

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3.2.2. Star Topology. A star topology is arranged like a star, with cables extending from a central location. Cables are not shared; each PC has its own dedicated cable (see Figure 3-2). Cabling workstations in a star tends to be more expensive. However, with a star topology the entire network does not depend on one bus cable. If one cable were to fail, it would only bring down the PC connected to that cable. All network traffic from one workstation to another workstation must pass through a central controller, which is responsible for managing and controlling all communications.

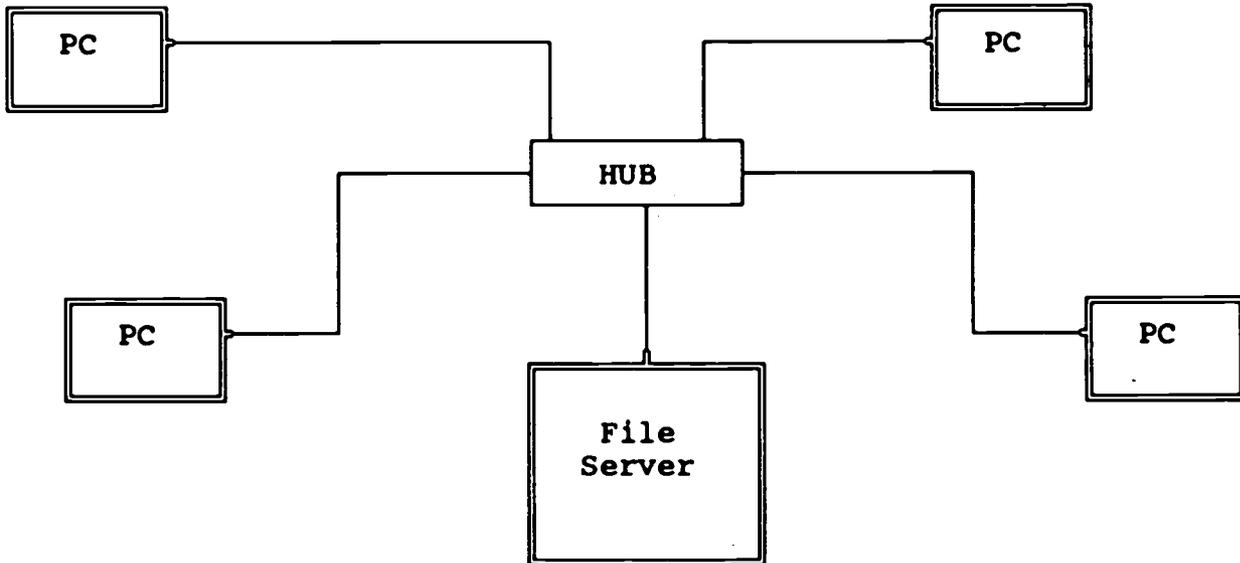


Figure 3-02
STAR TOPOLOGY

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3.2.3. Ring Topology. The ring or star-cabled-ring topology uses a combination of shared and dedicated cables. Workstations are connected to a Multi-Station Access Unit (MSAU). The MSAU is then connected to other MSAUs. The connected MSAUs form a ring (see Figure 3-3).

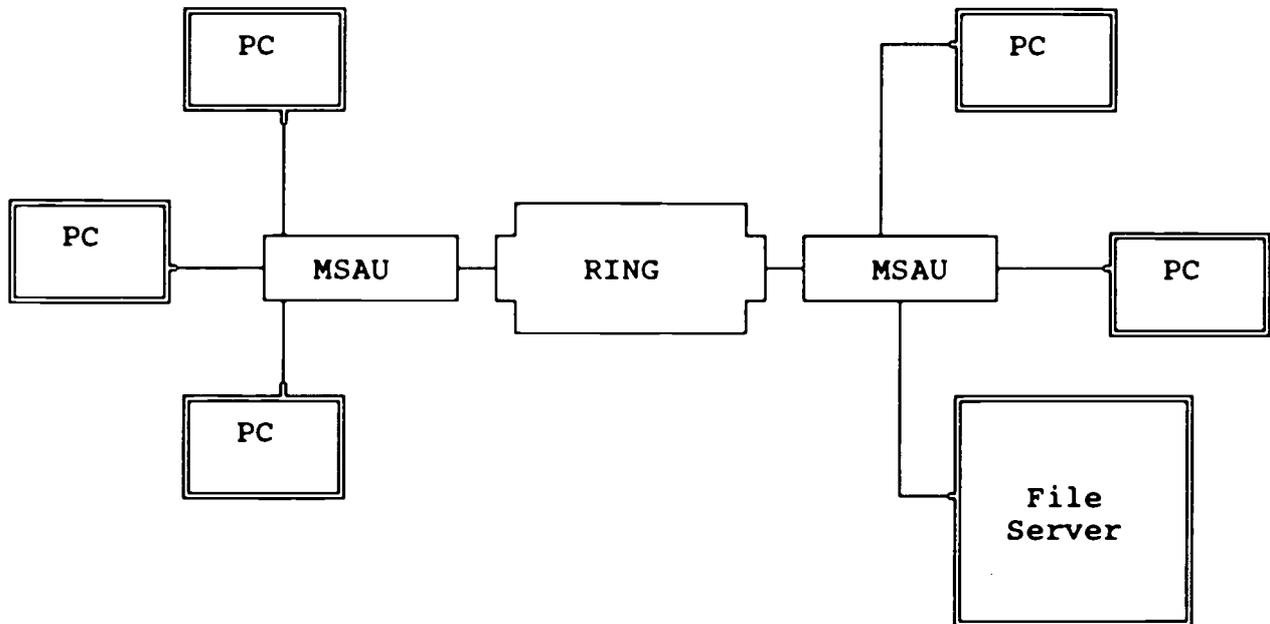


Figure 3-03
RING TOPOLOGY

3.3. CABLING SYSTEM. The cabling system is the hardware that allows communication between workstations and other LAN devices. LANs can run on varying types of cabling systems. The three most common LAN cabling systems used in the Marine Corps are Ethernet, Arcnet, and Token Ring. Each cabling system has its own characteristics. These characteristics are helpful to the network designer in determining which cabling system to utilize for a particular network.

3.3.1. Cabling Characteristics. The main network characteristics of any cabling system are speed, distance, protocols supported, reliability, ease of installation, and cost. The three cabling systems most common in the Marine Corps have distinct advantages and disadvantages. The figures below list the main features of each cabling system and provide a summary of network characteristics (see Figures 3-04, 3-05, 3-06, and 3-07). More details about each of these cabling systems is provided later in this chapter.

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	ETHERNET		
	Thin	Thick	UTP
Standard	IEEE 802.3	IEEE 802.3	IEEE 802.3i
Speed	10 Mbps	10 Mbps	10 Mbps
No. of devices per segment	30	100	N/A
No. of devices per network	1024	1024	1024
Max length per segment	607 ft.	1640 ft.	328 ft.
Cabling	RG58 Coax w/BNC's	Thick Ethernet w/XVRS	2-Pair, 24-AWG UTP w/RJ-45s
Network Architecture	BUS	BUS	STAR

Figure 3-04
Ethernet Characteristics

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	ARCNET			
	Coax star	Coax bus	UTP Star	UTP Bus
Standard				
Speed	2.5 Mbps	2.5 Mbps	2.5 Mbps	2.5 Mbps
No. of devices per segment	N/A	8	10	10
No. of devices per network	255	255	255	255
Max length per segment	2000 ft.	1000 ft.	400 ft.	400 ft.
Cabling	RG62 Coax w/BNC's	RG62 Coax w/BNC's	1-Pair 24-AWG UTP	1-Pair 24-AWG UTP
Network Architecture	STAR	BUS	STAR	BUS

Figure 3-05
Arcnet Characteristics

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	TOKEN RING	
	Type 1	Type 3
Standard	IEEE 802.5	IEEE 802.5
Speed	4/16 Mbps	4/16 Mbps
No. of Devices per segment	N/A	N/A
No. of devices per network	255	255
Max length per segment	Varies	
Cabling	IBM Type 1	IBM Type 3
Network Architecture	RING	RING

Figure 3-06
Token Ring Characteristics

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SUMMARY OF NETWORK CHARACTERISTICS			
	Ease of Installation	Cost per node	Advantages
ETHERNET			
Thick	Simple	Low	Speed, connectivity, cost, Supported by national and/or international standards bodies
Thin	Complex	High	Speed, distance, reliability, Supported by national and/or international standards bodies
UTP	Moderate	High	Speed, use of existing twisted-pair cable, Supported by national and/or international standard bodies
ARCNET			
Coax star	Simple	Moderate	Ease of installation, cost, reliability
Coax bus	Simple	Low	Cost, ease of installation
UTP star	Simple	Moderate	Ease of installation, cost, use of existing twisted-pair cable
UTP bus	Simple	Low	Ease of installation, cost, use of existing twisted-pair cable
TOKEN RING			
Type 1	Moderate	Moderate	IBM connectivity, use of shielded cable, support for 16MB/sec
Type 3	Simple	Moderate	IBM connectivity, use of existing twisted-pair cable

Figure 3-07
Summary of Network Characteristics

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3.3.2. Cabling Components. There are several very important components of a cabling system such as repeaters, connectors, barrel connectors, T-connectors, terminators, hubs, and MSAUs. The use of each component depends on the cable system that is to be installed. It is important to understand the basic function of each one of these components.

a. Repeater. Use of a repeater can significantly increase the maximum length of a LAN and is typically used in an Ethernet, ARCNET, and Token Ring cabling system. A repeater is a device that amplifies signals from one piece of cable and passes them on to another piece of cable without changing the signal content.

b. Connectors. Connectors are used to attach cable ends to devices like television cable boxes, television cable splitters, or various LAN devices. There are many different types of connectors used to attach LAN devices to cable, which are dependent upon the cabling system being used. The most commonly used connectors for cabling systems are:

- (1) Data connectors for Token Ring.
- (2) RG62 BNC Coaxial crimp or twist-on for ARCNET RG62 coaxial.
- (3) RG58 crimp connectors for ThinNet Ethernet or N-type connectors for thick Ethernet.
- (4) RJ-45 connectors for UTP Ethernet.

These connectors can be purchased already attached to the cable or the purchaser may buy the connectors separate from the cable. The connectors purchased separately are typically either the twist-on, crimp, or solder type. If crimp or solder type connectors are purchased it is important to have the necessary crimping or soldering tools available to fasten the connectors to the cable.

c. T-Connectors. In an Ethernet cabling system there are other commonly used connectors such as barrel connectors and T-connectors. Barrel connectors are shaped like a barrel and are used to connect two cables together. T-connectors function similar to a television cable splitter; instead of adding an additional television to the cabling system, you are adding another LAN workstation or file server. The T-connector is shaped like the letter T with a port on each end. These three ports are used to connect the NIC and two LAN cable segments. These cable segments must be terminated at the last workstation where no further cable is attached, as no T-connector port can be left open. In an Ethernet cabling system the most commonly used terminator is the 50-ohm terminator.

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3.3.3. Ethernet Cabling Systems. Ethernet can be configured with two different topologies and four types of cable. These topologies and cables can be combined for maximum versatility and cost-effectiveness. The cables and their respective topologies are:

<u>CABLE TYPE</u>	<u>TOPOLOGY</u>
Standard Ethernet Coax	Bus
ThinNet Coax (RG58 C/U)	Bus

<u>CABLE TYPE</u>	<u>TOPOLOGY</u>
Fiber-optic	Star
Unshielded	Star

a. Performance Features. The speed of Ethernet is 10 Mbps regardless of cable choice, but the distance will change dramatically with different types of cable. Listed below are summarized features for each type of Ethernet cable.

(1) Standard Ethernet

- Up to 100 devices attached to a single segment.
- Possibility of longer segment lengths--up to 1640 feet, eliminating the need for power devices to traverse the distance.
- Standard Ethernet cables give you more interference protection than other types of copper cable.
- Repeaters and bridges can extend the distance on a network.
- Devices attach to the network via transceivers.

(2) ThinNet Ethernet

- Economical choice for 30 or fewer users per segment and shorter segment requirements; maximum is 607 feet.
- Most Ethernet Network Interface Cards (NICs) have built-in BNC transceivers. This eliminates the need for separate transceivers, as connections can be made directly to the ThinNet cable.
- T-connectors are used for direct connection to cable. Workstations are daisy-chained with an "in-and-out" cable to each.
- A BNC transceiver and a transceiver cable are required when the interface card does not have a built-in BNC transceiver.

(3) Twisted-Pair Cable

- There are two versions of Ethernet over unshielded twisted-pair; UTP Ethernet and 10Base-T. 10Base-T

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Ethernet is the standard. UTP Ethernet is pre-standard. They can coexist on the same network when each segment is attached to a common repeater via a transceiver and a transceiver cable.

- Use 24 AWG, unshielded twisted-pair (standard telephone wire) to connect workstations to a central concentrator.
- Concentrators can be daisy-chained and can be attached to a fiberoptic or coax backbone.
- Maximum distance from concentrators to each workstation is 328 feet.
- Ethernet network interface cards (NICs) are available with built-in 10Base-T or UTP transceivers.
- Twisted pair is the most economical cable type and is easiest to work with. However, it is not recommended for installation with abundant interference (i.e., over fluorescent lights).

(4) Fiberoptic Ethernet

- Greatest point-to-point distance (1.3 miles).
- Completely free of interference.
- A fiberoptic hub or multi-port repeater is required to carry the signal to multiple devices.
- Segments run point-to-point only. Fiberoptic cable cannot be easily tapped or daisy-chained; special tools/skills are required.
- Provides the best distance and signal quality.
- Immune to electronic eavesdropping.
- Eliminates grounding problems and voltage spikes when used outdoors to link multiple buildings (requires outdoor cable).

3.3.4. ARCNET Cabling Systems. In a ARCNET cabling system, hubs are used in a star topology to increase cabling distance by regenerating the signal and to add workstations to the network. In a star network using RG62 cable, workstations can be placed up to 2000 feet from an active hub. An active hub (a device that will regenerate an ARCNET signal on 4, 8, or 20 ports) is used to add workstations to the network. Active hubs can be daisy-chained for a total distance of 20,000 feet. To cut down on total network cost, passive hubs (non-powered devices that split

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an active hub channel into three independent channels) can be added to active hub ports. Devices connected to passive hub ports must be within 100 feet cable distance, and a passive hub may be no further than 100 feet from an active hub port. The ports not being used on a passive hub, unlike an active hub, MUST be terminated using a 93-ohm terminator because RG62 Coaxial Cable is 93-ohm. The most commonly used connector for RG62 Coaxial cable is BNC. The three types of BNC Coaxial connectors that can be purchased are crimp, solder, and twist-on. ARCNET can be configured with four different topologies and two types of cable. ARCNET's versatile topologies make it an attractive network choice unless speed or standards are a factor in deciding what cabling system to use. The topologies and their respective cable types are:

<u>TOPOLOGY</u>	<u>CABLE TYPE</u>
Coax Star	RG62 Coaxial
Coax Bus	RG62 Coaxial
Twisted-Pair Star	Unshielded
Twisted-Pair Bus	Unshielded

a. ARCNET Performance Features. The main features of an ARCNET cabling system are its diversified topologies, cost, and distance. The speed of ARCNET is 2.5 Mbps regardless of cable choice. Listed below are summarized features for each type of ARCNET topology.

(1) COAX Star

- Workstations can be placed up to 2000 feet from an active hub.
- Active hubs can be daisy-chained for a total distance of 20,000 feet (almost 4 miles).
- The main benefits of using the ARCNET coax star topology are distance and fault isolation. Since most users have individual ports on an active hub, one cable fault would not effect the network.
- Passive hubs can be added to active hub ports to cut down the total network cost by splitting an active hub channel into three independent channels.
- Devices must be within 100 feet of a passive hub, and a passive hub may be no further than 100 feet from an active hub port.
- Unused ports on a passive hub must be terminated with a 93-ohm terminator.
- It is not possible to daisy-chain passive hubs.

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(2) Coax Bus

- Hardware costs associated with ARCNET are reduced by using an ARCNET bus card to connect up to eight users to a RG62 coax backbone. The backbone must be terminated at both ends with 93-ohm terminators, and end-to-end distance cannot be more than 1,000 feet.
- A T-connector at the coax connection of the ARCNET bus card allows an "In" and "Out" port.
- Bus and star topologies can be mixed by attaching an active hub to the end of a bus segment instead of the terminator.
- Coax Bus topology reduces the cost of adding active hubs and one cable can serve several workstations.
- A cable fault will affect all daisy-chained devices on that segment.
- To get more than 1,000 feet or eight workstations, you may use an active link to regenerate the signal and allow connection of a second segment. There is no limit to how many active links may be used other than the 20,000 foot cable limitation.

(3) Twisted-Pair Star

- ARCNET can be used with unshielded twisted-pair cable (standard 24-AWG telephone cable).
- Workstations can be located up to 400 feet from a twisted-pair hub.
- Twisted-pair repeaters may be used to double this distance.
- Every ARCNET card in a twisted-pair star must have a 105-ohm terminating resistor installed in the unused port of the card.
- Twisted-pair and coax can be joined with a twisted-pair link.
- Twisted-pair ARCNET cost is low and easy to install. It uses only one twisted-pair, which can run in the same jacket as telephone or other data line. This saves the cost of additional cable.
- Balun connectors can be used to convert star coax cards and active hubs to twisted pair, although baluns will not work opposite a built-in twisted-pair device.

(4) Twisted-Pair Bus

- Up to ten workstations can be connected to a twisted-pair bus, with a length of 400 feet. Each twisted-pair card has an "In" and "Out" port. The first and last cards must be terminated with a 105-ohm resistor.
- A twisted-pair repeater may be used to expand to multiple segments, allowing 400 feet and ten workstations per segment.
- Twisted-pair segments can be added onto an active hub to expand the number of workstations.

3.3.5. Token Ring. In a Token Ring cabling system, workstations and file servers are connected to a Multi Station Access Unit (MSAU) which acts as a hub. MSAUs are most commonly available in an eight-station configuration, but some 4 and 16 port units are available. The common 8 port MSAU will have eight ports to which the computer devices will attach, along with one RI (Ring In) and one RO (Ring Out) port to attach to other MSAUs. The MSAU internal configuration forms a ring topology. Each MSAU alone is a ring because the internals of an MSAU pass the signal from port to port. MSAUs in a ring topology comprised of more than one MSAU are linked together by connecting the cable from the ring out port on one MSAU to the ring in port on another. Data packets are passed from port to port until a destination address is reached or an error occurs. The LAN devices are typically attached to the MSAU using the Type 1 adapter cable and MSAUs are attached to other MSAUs with Type 3 patch cable. Terminators are not used in a Token Ring cabling system.

a. Token Ring Cabling. Token Ring is a 4 or 16 Mbps LAN ring topology developed by the IBM Corporation. Token Ring networking is known for its fault tolerance and predictable degradation, as well as its SNA connectivity. It is based on a star-wired-ring topology. Token Ring topology is based on cable configuration in regards to speed and distance. There are several cabling options available to interconnect a Token Ring LAN to include Type 1, Type 2, Type 3, and Type 5 (Fiberoptic) cable. Type 1 cable consists of two individually shielded twisted pairs, and is suitable for 4 or 16 Mbps applications. It is used for the LAN devices (lobes) and main path interconnections. Type 2 cable consists of two individually shielded twisted pairs and four unshielded twisted pairs. The shielded pairs are suitable for 4 or 16 Mbps applications for the LAN devices and main ring path interconnections, and the unshielded pairs are available for phone service, RS-232 data, etc. Type 3 cable is high-quality unshielded twisted-pair phone wire. It is strongly recommended that Type 3 cable be used in 4 Mbps Token Ring applications and not for most 16 Mbps rings. Type 5 is fiberoptic cabling used for the main ring path to

interconnect MSAUs for great main-ring distances or where inter-building connections are required. This is the only recommended method for connecting between buildings, because surge and ground-loop problems are so common in inter-building connections. Listed below are summarized features for Token Ring topology using IBM's Type 1 or 2 configuration and Type 3 Configuration.

(1) Type 1 or 2 Configuration

- All cabling between the computers and MSAUs is Type 1 or Type 2 cable. This way the wiring scheme can reliably support both 4 and 16 Mbps Token Ring installations.
- The maximum distance from the MSAU to the computer is 330 feet.
- The distance allowed for the main ring path (total distance between MSAUs) is variable, and depends upon the number of wiring closets, MSAUs, and whether the speed is 4 or 16 Mbps.
- Allows up to 255 devices per ring.

(2) Type 3 Configuration with "IBM type" conventional MSAUs

- Type 1 cable is used for the backbone ring between MSAUs.
- All cabling between the computers and MSAUs will be Type 3 unshielded twisted-pair.
- The maximum distance between the computer and MSAU is 150 feet and a ring can support up to 72 devices.
- A 16/4 Meg Media Filter is required for each node. This filter provides the physical conversion from the Token Ring Adapter's DB9 female connector to an RJ-11 plug, and also filters interference.

It should be noted that there are other methods of implementing a Type 3 Token Ring network using (other than IBM) active MSAUs that provide signal conditioning. The primary benefit in this arrangement is that distances between computer and MSAU can be greatly increased. However, these MSAUs are intended only for applications within one building because of possible electrical problems in crossing from one building to another. As in other Token Ring applications the main ring path distance is variable.

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3.4. OTHER LAN COMPONENTS. It is also possible to connect more than one LAN or network together, which enables users to share resources outside their localized area. These foreign networks and LANS may or may not use the same NOS, but the requirement to route traffic to or through these networks may exist. Hardware components such as modems, routers, bridges, gateways, and controllers provide this connectivity. The remainder of this chapter explains the different components utilized to connect networks.

3.4.1. Modems. A modem is used to convert digital signals into analog signal and vice versa, a process known as modulation-demodulation. Traditionally, modems are used to convert a computer's signal so that it can be transmitted over existing phone lines. A modem at the other end of the line re-converts the information so that it is understandable to another computer. In a LAN environment, modems are often used to connect networks and PCs that cannot be linked using LAN cables.

3.4.2. Bridges. The main purpose of a bridge is to link together two networks of like protocol, allowing communications between devices on separate LANs. In the process, other advantages are gained; most importantly, the bridge manages network traffic. The most commonly used bridges in the Marine Corps between LANs are IBM-compatible PCs and BANYAN certified file servers. The key components of a PC or file server operating as a bridge are the NICs and software to support the bridging function. The network interface cards are used to connect the two networks together. Bridge-management software products facilitate the building and defining of multiple paths in a bridged configuration, and randomly disable a path to avoid transmissions that result in an endless loop. This type of bridge allows an administrator to manage specific paths by setting priorities and controlling them. Bridges pass data transparently between similar networks without altering or manipulating the contents. The bridge receives messages (packets) and checks the destination address of the messages it receives. If it recognizes that a message is intended for an active station on either side of the bridge, it routes the data forward. Another type of bridge is known as a remote bridge. Because the term remote implies the use of telecommunication lines that have varying speeds which will not be equal to local transmission, it is important to understand the characteristics and limitations of each.

a. Bridge Speeds. Since a remote bridge may be speed selectable, you must decide which speed will suit your requirements. With a serial communications link you are normally restricted to a maximum transfer rate of 38.4 Kbps. A standard voice-grade leased line has a maximum speed of 19.2 Kbps. Along with it, you will need a synchronous leased-line modem that supports the appropriate speed at each end of the link. If you decide on a DDS (Digital Data Service) line, you will get a line

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from the telephone company at the specified speed (up to 56Kbps) and you will need a CSU/DSU at each end of the link. A CSU/DSU is similar to a modem, but it is for a digital line. It may have options for either an RS-232 or a V.35 interface.

b. T-1 Bridge. A T1 bridge normally has two modes; full T1 (1.544 Mbps) and fractional T1 (56K, 128K, 256K, 512K, etc.). The full T1 requires a T1 CSU to interface the bridge to the T1 circuit. The bridge then utilizes the full 1.544 Mbps bandwidth. Fractional T1 normally requires a T1 multiplexor so that multiple channels can share the full T1 circuit. The sum of all the channels on the multiplexor cannot exceed 1.544 Mbps. The channels on a T1 multiplexor may have options for RS-232, RS-422, or V.35 interfaces. It is important to know that RS-232 is limited to 38.4 Kbps, V.35 is limited to 56 Kbps, and RS-422 is limited to 2,048 Mbps. The multiplexor channels must adhere to these specifications.

When selecting a remote link, keep in mind that a circuit of 64 Kbps or lower may greatly slow down your response time on any activity between sites. When using these speeds you should restrict usage to screen updates, word processing, or small file transfers. Any intensive program or application will severely degrade performance for all remote-link users.

3.4.3. Routers. Routers are file servers or PCs on the LAN whose sole function is to route signal traffic so that it arrives at its destination quickly. Routers can provide alternate routes for messages in the event a segment of cable were to break down. In this manner, routers can be thought of as the traffic cop of the LAN.

3.4.4. Gateways. A gateway is normally a combination of hardware and software that provides terminal or application services from a LAN to a mainframe or host running a dissimilar protocol and/or operating system. It is normally used to allow workstations on a LAN to access a host computer. Through this access you may be able to perform terminal emulations, file transfers, electronic mail services, or other applications.

a. Workstation Requirements. For the network workstations, very few modifications are necessary other than to the existing NIC and workstation shell. The user may need emulation software or a conversion application for the connection to the host. In most cases (5250 or 3270 gateways) a gateway server machine must be used. This is usually an 80286 or 80386 class machine (AT or compatible) which may be either dedicated as a gateway server or non-dedicated. The host must also be set up to acknowledge the gateway that will be installed. The setup is rarely complicated because the gateway normally emulates a standard piece of equipment.

b. Host Gateways. The Marine Corps predominantly connects

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LANs to mainframes or hosts via a non-dedicated server acting as a gateway. These gateways are normally attached to a communications controller (Front End Processor) which is connected to the host. A communications controller is specialized hardware and software for centralized systems. It front-ends the communications tasks and provides a parallel channel interface to the mainframe processor, as well as providing a communications link interface to the network (gateway). The controller's specialized hardware works in cooperation with the mainframe network software, and buffers and re-blocks data bound for the host and vice-versa. The mainframe and communication controllers used by the Marine Corps are two components of a SNA network.

c. SNA. System Network Architecture (SNA) is the de-facto industry standard and an international standard announced by IBM in 1974 for Wide Area Networks (WAN). This standard defines functions, formats, and protocols to be implemented in IBM and other vendor supplied hardware and software. This "open" architecture allows third party vendors to take part in providing system components.

3.5. WIDE AREA NETWORKS. Many of today's networks use public telecommunications facilities to give their users access to the processing capabilities and data storage facilities on the mainframe computer. Tactical broadcast and switched facilities can also be used to establish tactical WANs in a deployed environment. Networks that tie widely separated users together are called Wide Area Networks (WANs). Chapter 1 stated that Banyan VINES is the Marine Corps standard LAN operating system. Within Banyan, any server-to-server network which uses telephone line connections, tactical radio circuits, or tactical switched circuits to communicate constitutes a WAN, regardless of distance.

3.5.1. WAN Physical Requirements. The concept of a Banyan wide area network simply involves the connection of multiple servers. Standard data communications techniques are employed in designing and implementing this link. The physical requirements for installing a WAN link between two servers are listed below:

- Two servers installed with Banyan software.
- A Banyan Intelligent Communications Adapter (ICA) board installed in both servers.
- A data communications link between the two server locations. This link can be a dial-up line with dial modems or a dedicated circuit with synchronous modems attached.
- The WAN installation requires that the data circuit connect to the ICA board in each server, and that the

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appropriate port on the board is assigned and configured within the software.

3.6. SUMMARY. This chapter defined LANs and their components, as well as network expansion. A lot of detail was provided concerning the bus, star, and ring topologies and the benefits of three commonly used cabling systems; Ethernet, ARCNET, and Token Ring. The basic components of all three cabling systems are summarized below.

3.6.1. Ethernet Components

- Ethernet NICs (Required)
- Choice of Standard Coaxial, RG58 Coaxial, UTP, Fiberoptic cable
- Connectors, T-Connectors, barrel connectors, terminators (50-ohm)
- repeaters (optional)

3.6.2. ARCNET Components

- ARCNET NICs (Required)
- Choice of RG62 Coaxial, UTP cable
- Connectors, terminators (93-ohm) if passive hubs are used
- Active hubs (optional)
- Passive Hubs (optional)
- Repeaters (optional)

3.6.3. Token Ring Components

- Token Ring NICs (Required)
- Token Ring Adapter cable (DB9) for each NIC
- Token Ring Patch Cable for main path ring (data connectors included)
- MSAUs
- Repeaters (optional)

3.6.4. Miscellaneous Items. Modems, routers, bridges, gateways, and controllers were briefly explained as important components needed to expand the network to connect to other LANs

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and WANs.

3.6.5. Additional Items. For specific LAN/WAN hardware and software components see Appendix B for a list of Banyan Model Numbers. The next chapter will explain the Banyan VINES network operating system to include all VINES software, as well as third-party vendor software. VINES software and third-party vendor software, combined with the hardware components discussed in this chapter, will provide the necessary equipment needed to plan and install a LAN/WAN.

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CHAPTER 4

BANYAN NETWORK OPERATING SYSTEM

4.1. INTRODUCTION. The Marine Corps standard Network Operating System (NOS) is Banyan VINES. VINES (Virtual Networking System) is Banyan Systems Incorporated software operating system. VINES supports standard and proprietary protocols, and its modular structure supports present and future OSI (Open Systems Interconnect) model requirements. VINES is UNIX AT&T System V based with Berkeley BSD enhancements. VINES servers operate an optimized UNIX 5.3 multi-processing environment on any computer capable of running the VINES NOS software. The software is loaded on a file server(s) and workstations and is utilized to manage the networks shared resources and services.

4.1.1 Architecture. VINES features a "service-based" architecture that provides equal support of LAN and WAN architectures, multiple user services, mainframe like security, and a global naming scheme (StreetTalk). With VINES integrated communications, users have full access to all industry supported LANS. WAN connectivity is provided to networks running standard protocols such as SNA, TCP/IP, X.25, HDLC, or asynchronous support.

4.1.2. Server Software. The VINES server software is comprised of drivers, services, and tools. The drivers provide an interface to communications media such as a LAN, serial ports to a WAN, and input/output (I/O) devices. Services are a set of processes that provide network users with access to shared information and manage other resources within the VINES NOS. Services provide print, file, mail, and gateway services to users. All Banyan services have a private directory in the NOS that maintain, create, start, and delete functions as well as registering with StreetTalk and producing logfile reports. Banyan Tools provide an application interface for program development.

4.1.3. Client Software. The VINES PC or client software facilitates communications between workstations and VINES servers. The software is loaded on LAN workstations and provides the LAN and I/O connectivity. Currently, Banyan client software support is limited to DOS 3.X or higher. The components of the client software include a LAN device driver, a DOS redirector, a configuration database, and a configuration program. The LAN driver supports an interface to manage the NIC installed in the PC. The DOS redirector provides file and print redirection, environment information, and the StreetTalk interface. This software executes in the PC Random Access Memory (RAM) and requires approximately 130K. However, there are memory management tools (discussed later in this chapter) available to reduce this requirement.

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a. Existing MS-DOS based, PC compatible machines may be utilized as LAN workstations provided they meet the minimum specifications. These specifications are:

- (1) 512 kilobytes base memory; 640KB is recommended
- (2) floppy disk drive
- (3) 20MB Hard drive
- (4) One (1) open expansion slot
- (5) DOS version 3.2 or higher
- (6) 8088 processor or greater

4.2. PLATFORMS. Banyan VINES is a server-oriented network. The functionality of VINES servers (PC or proprietary) that are integrated into the LAN will depend on their hardware expandability and processor level. The choice of server platform (PC or proprietary) should be based on requirements, and requirements matched with machine capabilities. The Banyan Platform Certification Program Notices, published semi-annually, is a document that gives you precise information needed when selecting and installing hardware platforms for VINES. The Banyan Platform Certification Program is a collection of vendors who participate with Banyan to certify their systems as VINES servers. Figures 4-01 and 4-02 list six different software/hardware platforms that can be purchased from Banyan (See Appendix B for Banyan Model Numbers). It should be noted that the Corporate Network Server (CNS), Desktop Server (DTS), and Banyan Network Server (BNS) are no longer in production.

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CERTIFIED VINES PLATFORMS; Server Minimum Requirements

VINES SOFTWARE FOR VINES CERTIFIED PLATFORMS				
	VINES/486	VINES/SMP	VINES/386	VINES/386TEAM
CPU	Intel 80486	Intel 80486 Intel 80386	Intel 80386	Intel 80386
Clock Speeds	25-33 MHZ	33 MHZ	16-33 MHZ	16-32 MHZ
RAM	4-16 MB	4-256 MB	4-16 MB	4-16 MB
Cache	Supported	Supported	Supported	Supported
Supported Bus Types	ISA, EISA, MicroChannel	EISA	ISA, EISA, MicroChannel	ISA, EISA, MicroChannel
Max. LAN Cards	4	4	4	4
Supported Cards				
ARCNET	x	x	x	x
Ethernet	x	x	x	x
LANSTAR (1)	x			x
ProNET	x		x	x
StarLAN (1)	x		x	x
Token Ring	x	x	x	x
VistaLAN (1)	x	x	x	x
Max. ICA cards	2	2	2	2
Supported Disk Types	SCSI EDSI ST506 (1)	IDA SCSI	SCSI EDSI ST506 (1)	SCSI EDSI ST506 (1)
Max Disk Storage	Will vary with choice of hardware configuration			

1. Not supported on Micro Channel platforms.
2. For details on non-Banyan supported tape drives, including manufacturers and model numbers, contact your Banyan sales representatives or an Authorized Banyan Reseller.

(continued on next page)

figure 4-01

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VINES SOFTWARE FOR VINES CERTIFIED PLATFORMS				
	VINES/486	VINES/SMP	VINES/386	VINES/386TEAM
Total Printer Ports	10	10	10	10
Maximum Direct-Connect Serial	2	2	2	2
Maximum Direct-Connect Parallel	3	3	3	3
Max. Remote	10	10	10	10
Banyan Cartridge Tape Drives (2)	150 MB 60 MB (1)			
Battery Backup	External	External	External	External

1. Not supported on Micro Channel platforms.
2. For details on non-Banyan supported tape drives, including manufacturers and model numbers, contact your Banyan sales representatives or an Authorized Banyan Reseller.

Figure 4-01 (continued)

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Banyan's Own VINES-Optimized Hardware		
	Banyan/CNS486 (3)	Banyan/CNS (3)
CPU	Intel 80486	Intel 80386
Clock Speeds	25 MHZ	25 MHZ
RAM	4-24 MB	4-24 MB
Cache	Supported	Supported
Supported Bus Types	ISA	ISA
Max. LAN Cards	4	4

1. Not supported on Micro Channel platforms.
2. For details on non-Banyan supported tape drives, including manufacturers and model numbers, contact your Banyan sales representatives or an Authorized Banyan Reseller.
3. The Banyan/CNS486 and Banyan/CNS come pre-loaded with VINES software.

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Figure 4-02

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Banyan's Own VINES-Optimized Hardware		
	Banyan/CNS486 (3)	Banyan/CNS (3)
Supported Cards		
ARCNET	x	x
Ethernet	x	x
LANSTAR (1)	x	x
ProNET	x	x
StarLAN (1)	x	x
Token Ring	x	x
VistaLAN (1)	x	x
Max. ICA Cards	5	5
Supported Disk Types	SCSI	SCSI
Max Disk Storage	Will vary with choice of hardware	
Total Printer Ports	10	10
Maximum Direct-Connect Serial	4	4
Maximum Direct-Connect Parallel	3	3
Max. Remote	10	10
Banyan Cartridge Tape Drives (2)	2.2 GB 150 MB	2.2 GB 150 MB
Battery Backup	Internal	Internal

1. Not supported on Micro Channel platforms.
2. For details on non-Banyan supported tape drives, including manufacturers and model numbers, contact your Banyan sales representatives or an Authorized Banyan Reseller.
3. The Banyan/CNS486 and Banyan/CNS come pre-loaded with VINES software.

Figure 4-02

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4.3. SOFTWARE OPTIONS. In addition to the platforms listed in figures 4-01 and 4-02, VINES/286 and VINES 286 to VINES/386 upgrades are available for purchase from Banyan. VINES/286 release 4.0 server software is for IBM PC/AT and true compatible platforms. It supports the Intel 80286 CPU, 2 LAN cards, 2 ST506 disk drives, 1 ICA card (6 communications ports), 5 printer ports (3 serial and 2 parallel), 60 MB or 150 MB external cartridge tape drive with integrated software support, and an external battery back-up with integrated software support. VINES/286 to VINES/386 upgrade enables customers to easily trade up from VINES/286 release 2.10 or 3.x to VINES/386 release 4.00. The upgrade includes a full set of release 4.00 documentation, VINES/386 floppy set, and an upgrade option key. The option key, when loaded, will transform a VINES/286 server key into a VINES/386 server key. All options previously installed on the VINES/286 server will remain in effect after the upgrade.

4.3.1. Standard VINES. The standard VINES software for all platforms include StreetTalk, File services, print services, security, NetBIOS interface, VINES LAN bridging, and Network Administration. When a software platform is purchased, the package includes all VINES Base System software and documentation as well as a server key. Brief descriptions of each software component are listed below (see Appendix B for Banyan Publications).

4.3.2. StreetTalk. StreetTalk is a fully integrated, distributed directory service that lets you uniquely identify and manage every resource on a VINES network. These resources include users, services, lists, and servers.

4.3.3. Security. VINES Security is enforced in several ways on the Banyan VINES network. On each server, the VANguard service provides security by authenticating user logins. It makes sure that users can log in from their present location and that they are in conformance with security requirements. VANguard also is responsible for restricting access between servers. ARL (Access Right List) is another VINES security measure that is used to define network resource security. ARLs are a collection of users' StreetTalk names that have permission to use a particular resource, and their level of access.

4.3.4. FILE Services. File Services let users share and use information on the fixed disks in a VINES server. They manage DOS file storage on the server, identified by a StreetTalk name, allowing users to perform all the file-related tasks they normally do, such as editing files, running executable files, or renaming files. To a user, a file service seems to be a local PC fixed disk drive, such as drive C.

4.3.5. PRINTER Services. Printer Services let users share printers on the VINES network. Users don't have to go to a

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particular PC to use a printer. Network printers, identified by a StreetTalk name, are physically attached to servers (local)/Pcs (remote).

4.3.6. NetBios Interface. NetBios Interface (Network Basic Input/Output System) provides user access to the VINES NetBios services, which is identified by a StreetTalk name on a VINES server. A NetBios service consists of PC-resident NetBios emulation software and a service on the server. The service allows users to run application programs that require a NetBios interface, and doesn't require any special hardware.

4.3.7. Network Administration. Network Administration provides strong, comprehensive control throughout the network. Network additions, moves, and changes can be performed without disruption to network service.

4.3.8. Bridging. VINES LAN Bridging service allows connection to two separate networks that are using the same protocols. Other integrated software is available from Banyan to enhance networking capabilities (see Appendix B). These add-on software options are separate components from the VINES Base System software and include option guides and keys. All VINES options available for purchasing are listed in Figure 4-03.

4.3.9. Mail. The Network Mail option enables PC users to exchange electronic mail messages and DOS file attachments including word processing documents, graphics, and spreadsheets across any size network. Network Mail is fully integrated with StreetTalk and is available for all servers.

4.3.10. PC Printing. PC Network Printing option allows printers connected to VINES workstations to be shared in the same way as those directly-connected to network servers. This option increases the number of printers supported by a VINES server and provides the same administrative control as printers directly connected to servers. It provides multiple access to a single PC printer and is available for all servers running VINES release 3.0 or greater.

4.3.11. Management. The Network Management option helps you to optimize network performance by providing statistics that help you maximize individual server performance and improve inter-server network performance. This menu driven software allows the system administrator to view a wide range of network statistics, including data transmission rates, percentage of network utilization of all connected nodes and isolation of network problems. It is available for all servers.

4.3.12. Dial-In. PC Dial-In option enables remote users to work off-site by dialing into VINES servers via standard telephone connections at speeds up to 19.2 Kbps. The server component of the option supports multiple simultaneous dial-in connections via

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the server serial communications ports (Banyan ICA card). Remote PCs equipped with asynchronous modems may dial into a VINES server and access the same network services available to any network users. Auto-dial and auto-answer features are supported on Hayes 1200, 2400, 9600 V/Series Telebit smart modems. An Intelligent Communications Adapter (ICA) or serial communications adapter is a prerequisite. It is available for all servers. (See CMC WASHINGTON DC//CCI// message DTG 060031Z AUG 92 for governing policies on Banyan Dial-In.)

4.3.13. Server Connectivity. Server-To-Server LAN option allows LAN-connected servers to co-exist and communicate with each other. If your network connects servers by using a LAN, VINES Revision 4.0 requires that ALL 4.0 servers that co-exist on the LAN must have this option installed. Available for all servers with the exception of VINES/386 Team.

4.3.14. Token Ring Bridging. Token Ring Bridging option allows a VINES server to emulate an IBM computer that runs the IBM Token-Ring Network Bridge Program, enabling end nodes that reside on different Token-Ring LANs to communicate through the VINES server. Available for servers running VINES release 4.0 or greater.

4.3.15. TCP/IP Routing. TCP/IP Routing (Transmission Control Protocol/Internet Protocol) option lets VINES servers act as IP routers. This option enables servers to route IP traffic via Ethernet, Token-Ring, StarLAN and ProNET-10 LANs. A server with this option installed acts as a gateway to forward traffic passed from one foreign network, through the VINES network, to another foreign network. Available for all servers running VINES release 3.0 or greater.

4.3.16. TCP/IP Server-to-Server. TCP/IP Server-to-Server option lets you use existing TCP/IP networks to integrate VINES servers and networks. This option supports VINES server-to-server connectivity across TCP/IP networks. The sending and receiving VINES servers must have this option installed. Available for all servers (running VINES release 3.0 or greater) with the exception of VINES/286 and VINES/386 Team.

4.3.17. PC/TCP. PC/TCP option allows any PC on the VINES network to perform a wide range of TCP/IP applications including FTP File Transfer, TELNET Terminal Emulation, SMTP Electronic Mail, subnetting and routing, Unix r-utilities (i.e. rlogin, rexec), IBM 3270 and DEC VT100 and VT220 terminal emulation, and printing. Two versions of this option are available. One version operates over all VINES-supported LANs, enabling TCP/IP traffic from PC/TCP applications to travel across a VINES network to a foreign host and works in conjunction with the VINES TCP/IP Routing option. It is available for all servers running VINES release 3.0 or greater and supports PC DOS release 2.0 or greater. The other version operates only over VINES-supported

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Ethernet LANs and is used for TCP/IP traffic travelling directly across a TCP/IP network to a TCP/IP host, rather than across a VINES network. It is available for all servers running VINES release 3.0 or greater and supports PC DOS release 2.0 or greater.

4.3.18. Simple Mail Transfer Protocol (SMTP). SMTP Mail Gateway option lets you exchange SMTP mail messages with users on foreign networks. This option interprets and forwards standard SMTP mail. Additionally, it supports nonstandard or site specific mail address formats by allowing optional specification of a default mail router. When the option encounters unfamiliar address formats, it passes the mail message along to the default mail router for interpretation and forwarding. This option is fully integrated with VINES Network Mail and TCP/IP options so that forwarding messages to foreign hosts is completely transparent. Incoming mail is directed to your VINES mailbox. Prerequisites: VINES release 3.10 or greater, VINES Network Mail option, and TCP/IP Routing option. Available for all servers with the exception of VINES/286.

4.3.19. MacVINES. MacVines Mail Gateway option allows Macintosh users to exchange electronic mail messages and file attachments with VINES workstations and other Macintosh users over a VINES network. Prerequisites: Server installed VINES Network Mail option and an Ethernet card are required connect to the Macintosh. Available for VINES/386, VINES/386 TEAM, or CNS servers running VINES release 3.10 or greater.

4.3.20. Asynchronous T/E. Asynchronous Terminal Emulation option enables users on a VINES network to use their PCs as asynchronous terminals connected to host computers (i.e. mainframe). This option also features public domain Kermit File Transfer protocol. One port of an Intelligent Communications Adapter (ICA) or serial communications adapter and an asynchronous modem is a prerequisite. It is available for all servers.

4.3.21. 3270/SNA. 3270/SNA option enables PC users on a VINES network to emulate 327x terminals to hosts that use System Network Architecture (SNA). There are many versions of this option available. The 3270/SNA 16LU option is available for all VINES servers running Revision 4.0 (or later), and provides support for 16 sessions. It allows VINES customers to purchase an entry-level IBM 3270/SNA solution and add additional LUs as needed. It includes send/receive file transfer capability. 3270/SNA 32LU version supports 32 sessions, one line maximum with send and receive file transfer. 3270/SNA 64LU version supports 64 sessions, 32 sessions per line, two lines maximum. 3270/SNA 96LU version supports 96 sessions, 32 sessions per line, three lines maximum. The 32LU, 64LU, and 96LU versions are available for all VINES servers except VINES/386, VINES 386 TEAM, and VINES/286. Additionally, there is a VINES/286 16LU version that

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supports 16 sessions and file transfer, and a separate version available that adds send/receive file transfer capability for existing VINES 3270/SNA emulation. This version requires VINES release 2.1 software or later.

4.3.22. Advanced 3270. Advanced 3270/SNA option is an enhanced version of 3270/SNA including features such as better print capabilities and presentations (pen lights, mouse, etc.) and window capabilities up to four sessions. Minimum requirements include one version of the basic 3270/SNA option and DOS version 4.0 or greater. There are three versions available with advanced 3270/SNA to include 32LU, 64LU, 96LU. All versions of the advanced option also include the features of the basic 3270/SNA option.

4.3.23. Advanced 3270 w/Graphics. Advanced 3270/SNA Graphics option provides AP and S3G graphics, as well as all the features of the Advanced 3270/SNA options. Minimum requirements include one version of the Advanced 3270/SNA option and DOS version 4.0 or greater. There are three versions available with this option to include 32LU, 64LU, 96LU.

4.3.24. 3270/BSC. 3270/BSC option allows VINES users to connect to IBM mainframes running Binary Synchronous Communications (BSC) protocol. There are three versions available. One version supports 32 sessions, one line maximum. Minimum requirements include one NM115 adapter and a synchronous modem. Another version supports 64 sessions, 32 sessions per line, two lines maximum. Minimum requirements include two NM115 adapters and a synchronous modem per line. The third version of 3270/BSC option enables VINES servers to route SLR (Source Level Routing) frames to an adjacent token ring network.

4.3.25. X.29. X.29 Software option allows VINES network users to establish terminal emulation sessions with host computers over an X.25 network such as a Public or Private Data Network (PDN). This option makes the server appear as a Packet Assembly/Disassembly (PAD) system to X.25 host. This option requires prior installation of the Asynchronous Terminal option and the X.25 Server-to-Server option. Available for servers running VINES 4.0 or greater.

4.3.26. X.25. X.25 Server-to-Server option supports interconnection of multiple servers using the standard PDN which conform to the standard X.25 specifications. In addition, X.25 provides support for up to 128 Virtual Circuits (CNS or BNS with 4 ICA cards) or 64 circuits (DTS or VINES 386 with 2 ICA cards), and includes support for leased lines with speeds up to 64Kbps using synchronous modems. An Intelligent Adapter Card (ICA) or serial communications adapter for each connection to a PDN is a prerequisite.

4.3.27. Server-to-Server WAN. Server-to-Server WAN option is

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used for connecting VINES servers in multiple locations, creating a WAN. This option includes support for leased lines operating up to 64 Kbps using synchronous modems, or public switched telephone networks using asynchronous modems. The server-to-server WAN option can accommodate Marine Corps tactical radio and switched circuits in a similar fashion. Servers can dial other servers at scheduled times or on command. The software supports multiple communications lines, with each line requiring one port of the serial communications adapter. A prerequisite is an Intelligent Communications Adapter or serial communications adapter. This option is available for all servers.

4.3.28. Toolkit. VINES Applications Toolkit option allows developers to efficiently create distributed applications that utilize the full power of advanced VINES facilities. It lets developers concentrate on application development without the need to implement or manage complex inter-process communication mechanisms. It also provides portability of network applications across Banyan's current product family as well as future hardware platforms. The Toolkit is recommended for use only on non-production servers. The PC Virtual Terminal Access portion of the toolkit requires the Asynchronous Terminal Emulation option. TCP/IP Applications Interface (API) requires the TCP/IP Routing option. X.25 API requires the X.25 Server-to-Server option. Mail Gateway development requires the VINES Network Mail option. The Toolkit is available for all servers (with the exception of VINES/286) running VINES release 3.10 or greater in development or run-time environment.

4.3.29. Oracle Server. Oracle Server for VINES option allows access to local and remote databases as if they were stored directly on the user's PC. Users can join the databases into a single view, regardless of their physical location. Comprehensive file and record locking schemes allow users to simultaneously retrieve, update, and delete data from the same table. A prerequisite is a Banyan CNS or certified 386 server. These servers must be running VINES release 3.1 or greater, have at least 8MB RAM, and an 80MB hard disk. The client must have a minimum of 640KB RAM and DOS 3.2 or greater. The maximum number of simultaneous users for Oracle Server is 50.

4.3.30. MacLAN Connect. MacLAN Connect option provides file, print, and tape backup sharing between Macintosh and DOS PC users. It also enables Macintosh files to be stored on VINES servers to reduce storage costs and enable administrators to back up the files on VINES high capacity tape drives. A VINES-supported Ethernet or Token Ring card is required. Available for all servers running VINES release 3.0 or greater.

4.3.31. VINES SMP. VINES SMP (Symmetric Multi-processing) option is an upgrade (a SMP platform is also sold) that enables a single VINES network server to support multiple processors. VINES SMP also lets your VINES network server support more users,

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services, and applications. A server with multi-processors and VINES version 4.0 (or greater) are required to run VINES SMP.

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VINES PLATFORMS ADD-ON SOFTWARE MATRIX								
	286	386	386TEAM	486	DTS(6)	BNS(6)	CNS(6)	SMP
Network Mail	x	x	x	x	x	x	x	x
PC Network Printing (1)	x	x	x	x	x	x	x	x
PC Dial-In	x	x	x	x	x	x	x	x
Server-to-Server LAN	x	x		x	x	x	x	x
Token Ring Bridging (2)	x	x	x	x	x	x	x	x
TCP/IP Routing (1)	x	x	x	x	x	x	x	x
TCP/IP Server-to-Server (1)		x		x	x	x	x	x
PC/TCP (1)	x	x	x	x	x	x	x	x
SMTP Mail Gateway (3)		x	x	x	x	x	x	x
MacVINES Mail Gateway (3)		x	x	x			x	x
Asynchronous T. E. w/Kermit File Transfer	x	x	x	x	x	x	x	x
3270/SNA (4)	x	x	x	x	x	x	x	x
Advanced 3270/SNA (4)	x	x	x	x	x	x	x	x
Advanced 3270/SNA Graphics (4)	x	x	x	x	x	x	x	x
3270/BSC (5)	x	x	x	x	x	x	x	x

1. VINES release 3.0 or greater.
2. VINES release 4.0 or greater.
3. VINES release 3.1 or greater.
4. 3270/SNA (Contact your Authorized Banyan reseller for clarification).
5. 3270/BSC (Contact your Authorized Banyan reseller for clarification).
6. BNS/DTS/CNS - BNS and DTS are no longer in production. CNS 80386 and 80486 support all VINES options.

(continued on next page)

Figure 4-03

VINES PLATFORMS ADD-ON SOFTWARE MATRIX								
	286	386	386TEAM	486	DTS (6)	BNS (6)	CNS (6)	SMP
X.29 Software (2)		x	x	x	x	x	x	x
X.25 Server-to-Server		x	x	x	x	x	x	x
Server-to-Server WAN	x	x	x	x	x	x	x	x
VINES Application Toolkit (3)		x	x	x	x	x	x	x
Oracle Server for VINES (3)		x		x			x	x
MacLAN Connect (1)	x	x	x	x	x	x	x	x
VINES SMP		x		x	x	x	x	x

1. VINES release 3.0 or greater.
2. VINES release 4.0 or greater.
3. VINES release 3.1 or greater.
4. 3270/SNA (Contact your Authorized Banyan reseller for clarification).
5. 3270/BSC (Contact your Authorized Banyan reseller for clarification).
6. BNS/DTS/CNS - BNS and DTS are no longer in production. CNS 80386 and 80486 support all VINES options.

Figure 4-03 (continued)

4.4. PATCHES.

4.4.1. Description. Patches are pieces of software that fix problems in VINES. Banyan distributes two different kinds of patches: site-specific patches and general patches.

4.4.2. General Patches. General patches (revision level changes/maintenance) fix a large number of problems in the VINES network operating system. These patches include site-specific patches, other fixes not released as site-specific patches, and new functions that have been added to VINES. General patches are released to all Banyan customers. Starting with the VINES 4.00(1) maintenance patch, all general patches have only one patch level associated with them.

4.4.3. Site-specific Patches. Site-specific patches fix a small number of problems in the VINES network operating system. These patches are often generated for a single Banyan customer. For

example, Banyan has developed a restricted site-specific patch set (for Marine Corps Sites only) which permits servers (all platforms) to reboot and run without server keys once applied. One of the patches in the set removes the functionality of the other patch in the set. Banyan provides these fixes based on site-specific needs.

4.5. THIRD-PARTY SOFTWARE. Most applications available for the PC can be used with VINES. Banyan has committed to supporting existing industry standards to ensure the widest range of applications software possible is available to Banyan users. Two standards that Banyan supports are DOS 3.x and NetBios. Banyan has also documented additional interfaces (APIs) through different services provided as part of VINES. Third-Party applications can be services, client, or stand-alone utility programs that use VINES features and run on the server or on a PC. The Banyan Applications Directory publication provides a list of all third-party software compatible with VINES.

4.5.1. Gateways. A recommended third-party vendor for gateway software is Soft-Switch. The Soft-Switch SNADS Gateway/Banyan product connects Banyan mail users to a system that implements the SNA Distributed Services (SNADS) protocol. This connection enables users on a Banyan network to exchange messages and attachments with users of accessible foreign mail systems, as they do with other Banyan Mail users. Another recommended third-party vendor for VINES-compatible software is Trellis Software Products. Some of their products are listed below:

4.5.2. Trellis Software Products

a. Trellis Redirector connects additional drives to the VINES network. Redirector was designed for optical drives but also supports all DOS compatible drives. Redirector lets all users on the network access commercially published CD-ROM applications.

b. Trellis TackBoard is a bulletin board program designed to augment VINES Mail by providing a forum for large audience information distribution.

c. Trellis TimeTalk is a multi-user calendar system that has a user interface similar to Banyan Mail and other network services. It has full integration with VINES StreetTalk name catalog.

d. Trellis StreetMap allows users to create custom menus to access application programs, handle file maintenance, and access VINES facilities.

4.5.3. Memory. Applications that use a lot of memory present a potential problem for the client PC. Each application program uses memory differently, i.e., for the core program, additional

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program components, data manipulation, etc. Listed below is an outline of the memory used by some of the critical software running on a VINES workstation:

a. The resident Banyan network software takes up approximately 110KB (most LAN drivers will vary 1-3KB in size); the largest requires 168KB.

b. Other VINES software (extended functions) running on the PC takes up additional memory (i.e. NetBios uses 39KB, use of extended StreetTalk calls uses 8KB and semaphore services 15KB).

c. Each DOS version takes up a different amount of RAM: DOS 3.1 uses 39KB; DOS 3.2 uses 46KB; DOS 3.3 uses 55KB.

d. The DOS CONFIG.SYS file will use more memory depending on the number of files and buffers allowed.

e. Device drivers (ANSI.SYS and others) specified in the CONFIG.SYS file will require a variable amount of memory.

4.5.4. Memory Management. PC memory management products attempt to alleviate the limitations of DOS memory usage by recovering extra memory and allowing it to be used by DOS. They are different from conventional memory products that simply add extended or expandable memory. Expanded memory makes use of extra memory in excess of the base 640KB by setting up a page frame in DOS memory, accessible by DOS, and swapping chunks of memory from the expanded memory space into this page frame. Some programs can swap parts of their own code into expanded memory, but most do not and are limited to the 640KB limit of DOS. The memory management products key feature is the ability to take standard applications, including network software, mouse drivers, and other TSR programs, and place them in the memory area between 640KB and 1MB. This allows them to run under DOS while freeing the lower 640KB for other applications.

PC memory management products are very similar in functionality but approach the problem in different ways. Some products require a hardware card and supporting software. A number of products can provide the same features using the protected mode of the processing chip, requiring no additional hardware. Memory used to fill in the holes in high memory can be supplied on the hardware board or mapped from the extended memory of the PC. In the latter case there might be a minimum amount of extended memory required, some of which is used for memory mapping and to hold the memory management software. Listed below are two commonly used PC memory management products in the Marine Corps:

a. Quarterdeck's QEMM386 is a software application that runs on 80386 based systems. It can re-map unused high memory space into RAM to allow TSR programs such as the VINES client

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network software to be run in high memory.

b. RYBS Electronics, Inc. Hi386 is a software DOS extension for 80386 systems. It is based on RYBS's Advanced Memory Specification (AMS) - addressable between 640 KB and 1 MB boundary area.

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CHAPTER 5

NETWORK PLANNING

5.1. INTRODUCTION. This chapter provides detailed planning information to help determine if a LAN is required, and if so, how to plan its implementation. It is intended for use by managers and staff personnel involved in planning and implementing LANs. It is recommended that LAN planning personnel read Chapters 3 and 4 of this document before proceeding.

5.2. PLANNING. The decision to implement a LAN must be made after careful consideration of the requirements. Knowledge of LAN advantages counterbalanced with the knowledge of LAN disadvantages will enable the manager to make a more educated choice.

5.2.1. Advantages. The primary benefits of LAN usage are as follows:

- a. Improved productivity through automation of routine job functions.
- b. Improved information management through reduced duplication and improved accessibility.
- c. Improved personnel interaction through organizational information sharing.
- d. Reduction of costs through most cost-effective communications.
- e. Cooperative processing with links between PCs and mainframes.
- f. Standardization of computer and communications usage.
- g. Provides shared hardware resources such as disk space and peripherals.
- h. Improved consistency in the areas of security.
- i. Provides a single workstation with the capability of accessing multiple streams.
- j. Eliminates single-user workstation isolation from information sharing.
- k. Allows the use of distributed processing.
- l. Replaces multiple point-to-point networks.

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5.2.2. Disadvantages. The shortcomings of LAN usage are as follows:

- a. High cost.
- b. Increased training requirements.
- c. Increased management skills required.
- d. Intense planning requirements.
- e. More detailed and complex application development required.

5.2.3. Considerations. The decision to adopt a LAN solution should also be based on a knowledge of the alternatives to implementing a LAN. One alternative may be to remain in a standard workstation environment, thus forfeiting shared resources and messaging. Another alternative may be to implement a less technically oriented resource sharing device such as an A/B device switch or a small Private Branch Exchange (PBX).

a. Components. Any plans to implement a LAN must include consideration for its components to include PC workstations, the workstation operating system software, cabling, network interface card, file server, and the Network Operating System software. Some components may have already been acquired and may be used in the LAN implementation, while other implementations may require procurement of all components (see Chapters 3 and 4, and Appendix B).

b. Application Software. Planned activities for LAN usage of application software must be included in the planning for implementation. Activities such as word processing, database management, spreadsheet application, host emulations, data capture, calendaring, electronic mail, and formal Marine Corps Class I and II applications must be considered when planning for the LAN. Previously purchased software for stand alone use or Class I and II software may not work when a PC is introduced to a LAN environment. LAN-licensed software that supports multiple users (eliminating the need for stand alone software; e.g., ENABLE, Harvard Graphics, etc.) may need to be procured to allow for full functionality of the LAN. Existing software can still be used when the PC is alternatively used in a stand alone mode. For those LAN implementations in which existing PCs and software are to be used consideration must be given to:

(1) what software should remain in the PC for stand alone use by the individual user.

(2) what software will become excess and will no longer be required to be maintained by the command.

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(3) what software must be integrated/upgraded to network packages for LAN use.

(4) how to implement a copyright software protection program to keep people from illegally copy software from the network server.

c. Management. Careful planning and management are necessary to ensure that the LAN implementation is accomplished in an effective, efficient and secure manner. System design must allow information distributed throughout the network to be accessible when and where it is required. The tasks required to administer and operate LAN equipment are commonly referred to as "Network Administrator" functions and represent an expanded role for organizational personnel. A Network Administrator should be appointed as early in the planning stage as possible (see Chapter 2 for administrator's responsibilities).

d. Security. Considerations should be given to whether the placement of software on the network or the attachment of equipment to the network will jeopardize the data stored on the network. TEMPEST devices may be connected to an unclassified network, as long as the workstation is not processing classified data. Also, correct procedures must be followed to add NICs to TEMPESTed PCs. The TEMPEST accreditation of a PC can be nullified if an untrained person opens the TEMPESTed PC.

e. Virus Protection. One of the biggest advantages of networking, is the ease of sharing data. Unfortunately, the ease at which data is passed from user to user is also the biggest problem for combating virus contamination. A firm command policy that prohibits users from loading non-USMC software; along with the implementation of automatic virus scanning software will keep the network virus-free.

5.2.4. Activities. While organization responsibility for many tasks can be clearly specified based on current documented organizational functions, some tasks may be performed by the organization desiring the LAN. The choices of who will perform what tasks is dependent upon existing levels of expertise, the desire to develop resident expertise, and personnel constraints in the organization.

5.2.5. Equipment. Specification of equipment required by model and feature is normally the responsibility of either the Regional Network Support Representative (see Appendix E), RASC or ISMO. In some cases, the receiving organization may accomplish this function. In either case, the Regional Representative, RASC or ISMO should certify the equipment lists prior to procurement for technical feasibility and adherence to standards as well as preparing requisitions for Automatic Data Processing Equipment (ADPE).

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5.2.6. Requirements. The requirements definition begins with identification of areas in the organization that would be expected to realize productivity gains if a LAN were installed. When defining requirements, organization management should identify the functional requirements for information sharing, office automation activities and requirements to access data at remote locations. Having a good understanding of the user's requirements will aid in capacity planning and will help to determine integration requirements with other LANs and the Marine Corps Data Network (MCDN). It will be helpful if the user is informed about all of the services that can be supported during baseline training. Each of the following items should be considered as part of the system:

a. Number of users - total and anticipated active users that might be on the network at one time.

b. Number of workstations - total PCs that would be active at one time. (This is usually the total of all the PCs in the organization.)

c. Percentage of growth anticipated - users and workstations.

d. User services:

(1) Personal Computer (PC) based applications software

(2) Shared peripherals; printers, modems, etc.

(3) Electronic Mail

(4) Office Automation; scheduling, calendaring, etc.

e. WAN/Communication:

(1) 3270 emulation

(2) Remote Access

(3) Server to Server

5.2.7. Documentation. The forms in Appendix D are structured to assist organizations in an orderly and complete documentation of LAN requirements; detailed instructions are included. The use of these forms should produce a complete planning package that can be used by the organization and the Regional Network Support Representative to specify equipment to be ordered and to provide information for LAN design and configuration. The estimated costs of LAN equipment to be used for completing the planning forms in Appendix D can be taken from existing IS contracts and are subject to change without notice.

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5.2.8. Layout. Following the definition of equipment requirements, planning for the physical layout of the LAN equipment can begin. Equipment placement is determined in terms of physical location of each workstation and its associated peripherals, and the LAN server and its associated peripherals. Considerations include maximum allowable cable lengths, adequate power supply, appropriate physical environment, adequate office furniture and arrangement, and placement of shared equipment such as printers, supplies and manual storage, etc.

5.2.9. Site Survey. After receipt of a completed LAN planning package, a site survey should be conducted by the Regional Network Support Representatives and coordinated with the requesting organization to provide additional planning information. When the site survey is conducted, the organization should have available a floor plan of the area in which the LAN will be installed (a fire evacuation route plan can be used) and workstation placement requirements. Using the results of the site survey, an equipment list can be prepared. This list includes all equipment and cable required for the LAN installation by model and feature.

5.3. SUMMARY. The LAN planning package will assist in the preparation of requisitions for LAN items.

5.3.1. LAN Planning Package. The planning package should include the following documents.

- a. A Request of IS Services Form.
- b. A Workstation Requirements Form for each workstation to be on the LAN.
- c. A Workstation Summary Form.
- d. A Server Requirements Form.
- e. A Local Area Network Requirements Summary Form.

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Chapter 6

STANDARDS

6.1. INTRODUCTION. This chapter discusses the standard rules for assigning names in a Marine Corps LAN. Standardization of assigning names in a LAN makes communications between different groups and organizations easier and less chaotic. For instance, if two LAN administrators are unaware that they have used the same name to identify groups and organizations, conflicts may occur within the LAN. For this reason, a coordinated effort should take place between the LAN System Administrator and the LAN Regional Representative to put the naming standards into place. The following naming convention standards may be further referenced from IRM-5234-04 (Naming Conventions).

6.2. APPLICABILITY. Banyan VINES is the standard USMC NOS. To ensure interoperability between Banyan LANs and the Marine Corps Data Network (MCDN), both FMF and supporting establishment units must follow naming standards. This chapter provides naming convention procedures which must be incorporated when establishing users, groups, and organizations.

6.3. GENERAL GUIDANCE. All names will be assigned according to the document referenced above and should be as descriptive as possible. This will alleviate any ambiguities or confusion between organizations. All letters should be capitalized. The use of any special characters within names will be prohibited. Valid characters include numbers, letters, spaces, decimal points, and underscores.

6.4. ORGANIZATIONAL NAMES.

6.4.1. Major Commands. Organizational names will consist of a maximum of 15 characters and will correspond to the major command. Examples are:

MCB CPEN	2D FSSG	MCRD SAN DIEGO
MCCDPA QUANTICO	MCAS YUMA	3D MARDIV
4TH DWT	HQMC	1ST FSSG

6.4.2 Deployed Unit. Deployed units will precede organizational names with 'DPLD.'. Examples are:

DPLD.1ST FSSG
DPLD.3D MARDIV
DPLD.5TH MEB
DPLD.3D MAW

6.5. GROUP NAMES.

6.5.1 Description. Group names should also contain a maximum of 15 characters and will consist of a unit name or designation for

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FMF units. An abbreviated command designator may be used as identified in IRM-5234-04 (Naming Conventions).

6.5.2 Assignment. Assignment of group names will be accomplished through a coordinated effort between MCCDPA Quantico and the Regional Network Support Representatives. After names have been determined, they will be available on the MCCDPA Quantico Bulletin Board System (BBS) at AV 278-2617, or can be made available by E-Mail.

6.5.3. Additional Descriptive Information. Additional information may be added to a command designator to further identify or distinguish group names. Some examples are as follows:

SMU	-- SASSY MANAGEMENT UNIT
ISMO	-- INFORMATION SYSTEM MANAGEMENT OFFICE
2NDBN.7THMAR	-- 2ND BN, 7TH MARINE REGT
DENTAL 22AREA	-- 22 AREA DENTAL CLINIC
HQ 5TH MAR	-- HEADQUARTERS OF 5TH MARINE REGIMENT

6.6. USER NAMES.

6.6.1. Description.

a. User names will consist of a maximum of 31 standard characters (SPACES INCLUDED) and will contain either a T/O billet (if available) or a job description. Since user names may contain more characters, they can be more descriptive than groups or organizations. This is advantageous since there can be several people in a group and the more descriptive the users name is the easier it can be to locate them. Some examples are listed below:

OIC NETWORK CONTROL SECTION
NETWORK COBOL PROGRAMMER 31
SUPPLY OFFICER
DIR OF ACCOUNTING

b. Descriptions such as 3RD FCLX. AT DOCR.MQG should be avoided if possible due to an obvious lack of clarity. The item description that goes with the user name should contain at least the rank, first and last name, and the phone number of the individual. Amplifying information such as building number is optional.

c. Users may wish to abbreviate their formal names and use a nickname instead. These nicknames are assigned at the discretion of the Network Administrator and follow certain guidelines as well. These guidelines are as follows:

(1) If the user is defined to the Electronic Library and Mail System (ELMS), (i.e., the user **has a requirement** for

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wide area network connectivity), then the first nickname must be the user's accessor ID (ACID) so that the gateway software (Banyan Softswitch) that translates Banyan mail and ELMS user names will operate properly.

(2) Any subsequent nicknames will be the user's last name.

(3) Nicknames will not contain any profane or offensive words or phrases.

(4) If the use of the last name results in a duplication of a nickname, then the user's initials may be added. Local SOP should outline the method for creating a unique name.

6.7. RESOURCE NAMES. The following resource naming standards will be utilized as additional devices and resources are put onto a LAN.

6.7.1. File Servers.

a. Server names will consist of a maximum of 15 characters but only the first 14 letters should be used to describe the server. The last letter is reserved to designate the server number in the event several servers are used by the same organization. All server names will have this identifier appended to accommodate expansion at a later date.

b. The first three characters of a server name will be the MCDN node three letter identifier (i.e., ALA, KCT, BAM, CLB, MQG, etc.). Off-base units supported by the local command will use the three letter MCDN node identifier of the supporting command. Servers that are identified as deployable assets will use the following three letter designations:

DFU	-- Units supported by 1st FASC
DFV	-- Units supported by 2nd FASC
DFW	-- Units supported by 3rd FASC
ETERASC1	-- Server located at RASC El Toro
BAMIRM1	-- First server located at IRM BARSTOW
BAMIRM2	-- Second server located at IRM BARSTOW
ETEMAG39A	-- First server located at MAG 39 El Toro
DFU1STFSSG1	-- First deployable 1st FSSG supported by 1st FASC.

6.7.2. Printers and Plotters.

a. Printer names will consist of a printer type designator, a space, and then the word "PRINTER", followed by a numeric identifier. Plotter names will consist of a standard plotter size (A through E), a space, and the word "PLOTTER", followed by a numeric identifier. Some examples of printer and plotter names are as follows:

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LQ	-- Letter quality
DRAFT	-- Draft quality
LASER	-- Laser printer
WIDE	-- 132 column printer
COLOR	-- Color printer
LQ PRINTER1	-- 1st letter quality printer in a group
DRAFT PRINTER2	-- 2nd draft printer in a group
E PLOTTER4	-- 4th "E" size plotter in a group

b. The server description will contain the printer model, the form it takes and the location of the server.

6.8. EMULATION SERVICE.

6.8.1. 3270 Emulation. The names of a LAN-configured 3270 communications service/gateway will consist of "3270" followed by an alphabetic identifier to distinguish multiple 3270 services defined for a server. Some examples are:

3270A -- 1st service in a particular server
3270B -- 2nd 3270 service in a particular server

6.8.2. Asynchronous Emulation. If any asynchronous emulation service is to be added onto a server it should be named "ASYNCH TE". No additional information will be needed. The same holds true for any "NETBIOS" or "SEMAPHORE" services as well. Shared file services also follow the above guidelines and thus named "SHARED FILES". Should any application programs require their own service they will be named "(APPLICATION)".

6.9. ORGANIZATIONAL MAIL BOX (OMB) NAMES.

6.9.1. Item Name. The Item Name for a unit's OMB will begin with the first 27 characters of the unit's Plain Language Address (PLAD), followed by one space, followed by the letters "OMB". For example, the item name for the OMB for CG FMFLANT would be "CG FMFLANT OMB".

6.9.2. Nicknames. As with other Banyan naming conventions, the first nickname will be the ACID. The ACID for the OMB will end in a "Z". Units may choose to use official command abbreviations in subsequent nicknames to facilitate rapid addressal of E-Mail.

6.9.3. StreetTalk Directory Assistance (STDA) Entry. The STDA entry for an OMB will contain, at a minimum, the following information:

- a. The entire PLAD for the unit.
- b. The command designation from the IRAM.
- c. A point of contact with an autovon phone number.

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LAN INSTALLATION

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CHAPTER 7

LAN INSTALLATION

7.1. INTRODUCTION. This chapter outlines a set of procedures utilized to install a LAN. Network installation is a logically ordered set of procedures and actions that facilitate the implementation of all necessary LAN components. The previous chapters in this document discussed the components of a LAN, the VINES NOS, network planning, and procurement. During the network planning phase (see Chapter 5), network requirements are determined and a physical topology (cabling diagram) is drawn. A list of all network components identified for purchase is compiled during the network planning phase, and purchased during the procurement phase. Once the requesting site receives all necessary LAN components, the network installation phase is initiated.

7.1.1. Tools. This chapter's procedures assume that an operating system (DOS) has been installed on all PC workstations requiring access to the LAN and the requesting site has received all necessary LAN components. The following is a list of necessary tools required by network personnel performing the LAN installation:

- a. A printed copy of this entire document
- b. LAN Cabling Diagram (completed during network planning phase)
- c. LAN worksheets to include LAN Cabling Diagram (worksheet), First Server's Start-up Information, Server Configuration, PC Configuration, ICA Port Allocation, ICA Burst Consideration, Serial Communications Line Assignments
- d. Cabling tools; these tools are dependent on the Cabling system being used (i.e. Arcnet, Token Ring, Ethernet); Chapter 3 of this document discusses tools for cabling systems
- e. Network interface cards and accompanying documentation (see Chapter 4 for LAN cards supported on different VINES platforms)
- f. VINES LAN Documentation Set (The set dated Nov 1989 contains 18 LAN Installation Guides that describe how to install particular LAN cards in a VINES network)
- g. A set of VINES LAN diskettes (These diskettes, three 3 1/2-inch diskettes and two 5 1/4-inch diskettes, contain LAN drivers and diagnostic programs for each LAN card supported under VINES)
- h. A VINES master diskette (contains all the software

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required to connect your PC to a VINES network except the LAN drivers and the diagnostic programs)

i. VINES Base System Guides (Administrator's Planning Guide, Administrator's Reference, Server Operations Guide, Command Reference, and User Guide)

j. VINES Server Installation Guide(s) (Network Installation Guide for Banyan/CNS, Network Installation Guide for VINES/386 and VINES/286, Serial Communications Guide)

k. Vines Option Guide(s) for Add-On Software Options purchased

l. Cable and if necessary, components for cabling system being used (see Chapter 3); necessary components such as connectors, terminators, T-Connectors, barrel connectors, active hubs, passive hubs, repeaters, MSAUs, etc.)

m. File server selected during the planning/procurement phase(s)

n. VINES Network Operating System (NOS) software and server key selected during the planning/procurement phase(s)

o. VINES Option key(s) selected during the planning/procurement phase(s).

7.2. WORKSHEETS. The first step of network installation is to fill out the LAN worksheets with as much known information as possible. The information needed to fill out these worksheets can be compiled from this document as well as the LAN cabling diagram, the VINES Network Installation and Serial Communications Guides, the VINES LAN Documentation Set, and the VINES Base System Guides. Particular attention should be given to naming convention standards (Chapter 7 of this document); networking personnel should coordinate with all administrators (i.e. LAN, Group, Network/WAN) to ensure that established names are understood.

7.2.1. LAN Cabling Diagram Worksheet. The LAN CABLING DIAGRAM WORKSHEET is used in conjunction with the cabling diagram to plan and install cable for the LAN workstations (see Figure 7-01). The server is always the starting point and would be the first entry on this worksheet. The CABLE IDENTIFIER field identifies the cable used between workstations and servers. The FROM field explains the cable start point or station (PC/server) number. The TO field explains the cable end point. The USER/SERVER NAME field indicates the actual user/server corresponding with the workstation number/server in the FROM field. The last workstation or terminating point is identified on this worksheet as TERMINATE in the TO field. The OTHER NOTES field can be utilized for additional reminders.

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7.2.2. First Server Start-up Information Worksheet. The FIRST SERVER START-UP INFORMATION WORKSHEET information will be utilized to enter preliminary information at the server console during the Banyan Vines NOS install (see Figure 7-02). This worksheet is prepared prior to the server installation, which will enable the installer to readily supply the necessary information when prompted. The procedures for entering FIRST SERVER START-UP INFORMATION are found in the Vines Network Installation Guide, Chapter 3. The naming conventions utilized when filling out this worksheet will correspond with Marine Corps standards (see Chapter 6 of this document).

FIRST SERVER START-UP INFORMATION WORKSHEET	
Standard Time Zone	
Alternate Time Zone	
Date Server Installed	
Server Name	
Server Key Serial #	
First Organization Name	
First Group Name	
First Administrator	e e
Print Service Name	e e
Printer Type	
Printer Port	
Baud Rate	

Figure 7-02
First Server Start-up Information Worksheet

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7.2.3. Server Configuration Worksheet. The SERVER CONFIGURATION WORKSHEET is used during the Banyan Vines server installation to document hardware configuration (see Figure 7-03). This worksheet will be updated to reflect changes. It will also be used as a reference to avoid configuration conflicts between LAN cards and other server components. The procedures for adding or changing network cards and configuration values are defined in the Vines Network Installation Guide, Chapter 5.

a. Field Descriptions. A brief description of the Server Configuration Worksheet fields are listed below:

(1) SERVER NAME - The name of the server. (According to the naming standards.)

(2) SERVER LOCATION - Where is the server located; building number and office number.

(3) MAKE/MODEL - What kind of PC is being used as a server (CNS, Intel 386, Compaq 386, etc,.).

(4) PHONE NUMBER - A phone number in the office or building where the server is located. This will be used in case of an emergency.

(5) CPU SERIAL # - What is the serial number of the server; the hardware serial number.

(6) INSTALL DATE - Date when the server was installed.

(7) HARDWARE DEVICE - A list of all cards in the server.

(8) SLOT NUMBER - The slot in which the Add-in card physically resides.

(9) DMA - DMA channel software setting (rarely used).

(10) I/O ADDRESS RANGE- I/O Address Range of the card; list address that card is actually configured for without conflicting with other cards I/O address.

(11) RAM/ROM MEMORY ADDRESS RANGE - RAM/ROM address range of the card; list RAM/ROM address that card is actually configured for without conflicting with other cards RAM/ROM address.

(12) SERVER KEY # - Serial Number taken from the BANYAN server key.

(13) SOFTWARE VERSION - VINES NOS version number.

(14) SERVER OPTIONS - List of VINES options that have

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been installed on the server.

(15) FLOPPY/TAPE TYPE - Indicate type of drive and controller card.

(16) Drive # - Device number of physical floppy/tape drive.

(17) SIZE - List the capacity of the floppy/tape drives.

(18) MAKE/MODEL - Give the manufacturers name and model of the drives.

(19) DISK DRIVE TYPE - Indicate type of physical disk drive/controller card.

(20) Drive # - Device number of physical drive.

(21) SIZE - List the capacity of the disk drive.

(22) MAKE/MODEL - Give the manufacturers name and model of the drive.

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SERVER CONFIGURATION WORKSHEET				
SERVER NAME:			LOCATION:	
MAKE/MODEL:			PHONE # :	
CPU SERIAL #:			INSTALL DATE:	
HARDWARE DEVICE	SLOT NUMBER	DMA	I/O ADDRESS RANGE	RAM/ROM MEMORY ADDRESS RANGE
SERVER KEY #:			SOFTWARE VERSION:	
SERVER OPTIONS:				
FLOPPY/TAPE TYPE	DRIVE #	SIZE	SERIAL #	MAKE/MODEL
DISK DRIVE TYPE	DRIVE #	SIZE	SERIAL #	MAKE/MODEL

Figure 7-03
Server Configuration Worksheet

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7.2.5. ICA Port Allocation Worksheet. The ICA PORT ALLOCATION WORKSHEET is used to determine the load on the BANYAN Intelligent Communications Adapter (ICA) card(s) installed in a file server and the load of the six lines connected to each card. The ICA card is used for synchronous and asynchronous communications. The procedures for completing this worksheet are located in the Serial Communications section of the Banyan Vines Network Installation Guide. Each time a line is assigned for use, this worksheet needs to be completed. It is important to remember that an ICA card's total load capacity is 144.8K when assigning options to a line connected to it. In Figure 7-05, the LINE # field designates the six lines connected to the ICA card. The OPTION NAME field lists the type of communications utilized on a particular line. There are five main options and they are classified as HDLC S-S X.25, 3270/SNA, 3270/BSC, ASYNC S-S PC DIAL-IN, and ASYNC TERMINAL EMULATION. ACTIVE LINE is used in calculating loads and only active lines should be calculated. The LOAD FACTOR field contains the amount of processing overhead that a protocol incurs. LOAD FACTOR is a constant that relates to the option being used and the line number assigned for that option. The constant values are listed in the Vines Network Installation Manual, Serial Communications section, Table 2-2. The LINE SPEED field is the baud rate used on the line. Lines 1 and 2 will support line speeds ranging from 110 to 64,000 Kilobytes Per Second (KBPS) for synchronous options and from 110 to 19,200 KBPS for asynchronous options. Lines 3 through 6 will support line speeds ranging from 110 to 19,200 KBPS for both synchronous and asynchronous options. Multiplying the Load Factor with the Line Speed will produce the value to be placed in the LOAD field. As a precaution, the total load should never exceed 100K.

ICA PORT ALLOCATION WORKSHEET					
LINE #	OPTION NAME	ACTIVE LINE?	LOAD FACTOR	LINE SPEED	LOAD
1					
2					
3					
4					
5					
6					
TOTAL LOAD:					

Figure 7-05
ICA Port Allocation Worksheet

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7.2.6. ICA Burst Consideration Worksheet. The ICA BURST CONSIDERATION WORKSHEET is used to prevent the occurrence of transmitter underruns due to line burst situations; it helps reduce bad transmissions. Underruns only affect synchronous options running on lines 3 through 6 of the ICA card. The ICA card automatically prevents transmitter underruns on lines 1 and 2, but the worksheet needs to be used to calculate the accumulated burst of all synchronous and asynchronous lines. A BURST is when several lines on the card simultaneously perform their longest operation. This worksheet determines whether or not the line speed should be adjusted for an option on a particular line so that it can better respond to a burst and avoid a transmitter underrun (see Figure 7-06). For the fields LINE #, OPTION NAME, ACTIVE LINE and LINE SPEED on the worksheet, an explanation of each is stated in the Vines Network Installation Manual, Serial Communication section 2.5. The BURST field is a constant in relation to what option is being used and the line assigned. The values can be found in the Vines Network Installation Manual, Serial Communications section, Table 2-5. The NMI (non-maskable interrupt) is a constant of +71 and is used when calculating accumulated burst. The ACCUMULATED BURST field is derived by adding the burst value of each active line number that precedes this line, then the burst value of the current line, followed by the largest burst value of any active line that follows the current line and finally the NMI. The Vines Network Installation Manual, Serial Communications section, Table 2-6 shows the maximum burst for a particular baud rate. The servers worksheet is modified each time a line is installed, activated, or de-installed.

ICA BURST CONSIDERATION WORKSHEET						
LINE #	OPTION NAME	ACTIVE LINE?	LINE SPEED	BURST	NMI	ACCUMULATED BURST

Figure 7-06
ICA Burst Consideration Worksheet

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7.2.7. Serial Communications Line Assignments Worksheet. The SERIAL COMMUNICATIONS LINE ASSIGNMENTS WORKSHEET is used to keep a record of a server's line assignments made on an ICA card (see Figure 7-07). This is done after connecting a communication device (i.e.modem) to a line attached to an ICA card. The procedures for completing this worksheet can be found in the Network Installation Manual, Serial Communications section (Connecting a Line to a Communication Port).

SERIAL COMMUNICATIONS LINE ASSIGNMENTS WORKSHEET					
LINE #	OPTION	LINE SPEED	MODEM TYPE	PHONE NUMBER	NOTES

Figure 7-07
Serial Communications Line Assignments Worksheet

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7.3. CABLE INSTALLATION. The installation of LAN cable is the next step in network installation procedures. LAN cable should be installed in compliance with the requirements of the LAN you are using. Each room or office should have cable connections (drops) ready to attach to the server and to each PC. If cable and connectors were purchased as separate entities, the cable distance between devices should be measured, and that measurement used when cutting cable segments from a spool of cable. It is a good practice to add ten or more feet excess cable to each end of a cable segment before cutting, because this will permit some flexibility in moving equipment around the office. After cable is cut it is necessary to fasten connectors to both ends utilizing your cable tools and test the signal using a cable analyzer (tester) to ensure that there are no breaks in the cable segment. If you are using an Ethernet cabling system, attach T-Connectors to each connector on the cable segment and place a terminator on the first and last T-connector of a bus. Arcnet and Token Ring cabling systems require the placement of hubs/MSAUs in designated positions, which should have been laid out in the cabling diagram (drawn during the planning phase). Cable drops to Arcnet passive hubs and active hubs should be connected to assigned ports and active hubs powered up. After the connections have been made the cable should be tested again to ensure that all components are receiving a strong signal. Token Ring MSAU ports may have to be initialized before plugging cable drops into assigned ports. It may be helpful to design a MSAU PORT DESIGNATION WORKSHEET such as the one in Figure 7-08 to aid in future troubleshooting.

MSAU 8-PORT DESIGNATION WORKSHEET										
MSAU #	PORT NUMBER									
MSAU #	RI	1	2	3	4	5	6	7	8	RO

Figure 7-08
MSAU 8-Port Designation Worksheet

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7.4. SERVER INSTALLATION. VINES server installation requires the appropriate VINES Network Installation and Serial Communications Guides and the server configuration worksheets to be available before proceeding. Follow the procedures in Chapters 2 and 3 of the Network Installation Guide to install both the server hardware and software, including the network interface cards, server printers, VINES NOS, and VINES Options. Follow the procedures in the Serial Communications Guide to install and configure the BANYAN ICA card as well as configuring the lines and connecting modems (must be Hayes or Telebit V Series modems). Update the server and serial communications worksheets as required.

7.5. WORKSTATION INSTALLATION. Following a successful server installation, a LAN workstation (PC) must be installed following the procedures in Chapter 4 of the VINES Network Installation Guide. Listed below are the summarized steps needed to complete this task.

7.5.1. Network Interface Card. Configure the Network Interface Card for the PC and install it in an empty slot. If there are other cards already in the PC, this can become a difficult job. Refer to the VINES LAN Documentation Set for suggested settings.

7.5.2. VINES PC Software. In order for the card to access the LAN, VINES software must be installed on the PC from the VINES master diskette. Listed below are the VINES PC files with a brief explanation about what each one does:

a. BAN.EXE loads VINES software into PC memory and connects the PC to a VINES network.

b. BAN.MSB contains the error messages for the BAN.EXE program. If the BAN program is on your Vines diskette, do not delete BAN.MSB or its corresponding program will not work.

c. NEWREV.EXE upgrades PC network software to the highest available revision of VINES.

d. NEWREV.MSB contains the error messages for the NEWREV.EXE program. If NEWREV.EXE is on your VINES diskette, do not delete NEWREV.MSB or its corresponding program will not execute.

e. PCCONFIG.DB notifies VINES about the LAN card configuration. It also determines which VINES driver should be used by default whenever network software is loaded. This driver is called the default driver. PCCONFIG.DB also contains information about VINES network software. This can be used to simplify the logon process.

f. PCCONFIG.EXE sets the parameters used by a PC at login.

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- g. PCCONFIG.MSB contains the error messages for the PCCONFIG.EXE program. Do not delete PCCONFIG.MSB, or the PCCONFIG.EXE program will not execute.
- h. REDIR.EXE handles the supported revisions of DOS.
- i. REDIR.MSB contains the error messages of REDIR.EXE. Do not delete or the REDIR.EXE program will not execute.
- j. AUTOEXEC.BAT runs the BAN command to start the login process.
- k. xxxBAN.COM enables the LAN card to communicate on the VINES network.
- l. DIAGxxx.COM is the VINES diagnostic program and is included on the LAN master diskette.

(1) Build Master. Using the format /s command, prepare a blank, formatted DOS diskette containing the system files needed to boot the PC. Copy all of the files from the VINES Master Diskette onto the blank DOS diskette. Copy the LAN driver software you will need from the appropriate LAN Master Diskette onto the DOS diskette. This is the working diskette.

(2) Install. Place the working diskette into drive A of the first PC to be installed. Make a directory on the C drive and copy drive A to C. Remove diskette when finished.

(3) Configure. At the DOS prompt change directory to the directory containing the software just copied and type PCCONFIG. When the menu appears, choose the Network Card Settings option. Select the card being installed and enter the appropriate settings that match the hardware settings of the card and do not conflict with other settings. Change the Login Environment Settings to reflect the group and organization and save the configuration. For changes to take affect, the machine must be rebooted.

(4) Administrator Login. Once the machine shows the DOS prompt, change to the Banyan directory and type Ban. This begins the login process. After a few seconds the login screen should appear. At this time, log into the network using the first user name and accompanying password.

(5) Diagnostics. If the login prompt doesn't appear after rebooting, make sure that the cable is connected properly and then run diagnostic tests. Run PCCONFIG to check that the settings in the file PCCONFIG.DB match the settings on the LAN card. Check to see that the configurations of the LAN card do not conflict with another device in the PC.

7.5.3. Patches. If the login is successful (you logged in as

the administrator), update the PC Configuration worksheet and install any patches at this time. A patch can be considered as a software "Band-Aid" in that it is laid over a certain part of the NOS without having to update the entire operating system. To install a patch simply login to the network as the administrator, insert the patch diskette (that you received from Banyan or your software support group) into a floppy drive on the PC, access the floppy drive and type PATCH [servername]. The diskette is menu driven from there and will prompt you to answer several questions. When you are done installing the patch, the server will reboot automatically.

7.5.4. Users and Services. Create the additional users and services on the server (refer to the VINES Administrators Reference Guide for specific details) when the server is up and all basic services are running. The following summarizes the steps to creating users and services after the server is running:

- a. Login to Banyan as the system administrator.
- b. Type MANAGE at the prompt and press return.
- c. Choose the appropriate option that matches what you want to create. Remember to follow the naming standards and create the services. When all services have been created and started, press the ESC key until the cursor is at the prompt.
- d. Type MUSER and press return.
- e. Create new users following the naming convention standards. When all users have been created press the ESC key until the cursor is at the DOS prompt and logout.
- f. Install the remaining workstations repeating the workstation installation procedures mentioned above.

7.6. MEMORY MANAGEMENT. Most PC's come with 640KB of base memory. With the use of some third party software, base memory can be increased. If you experience memory problems with Banyan software loaded in base memory, you may consider using a memory management package that allows the use of high memory. Warfighting Support Branch at Quantico has tested several of these packages and recommends the use of two such packages: RYBS Electronic's Incorporated HI386 and Quarterdeck QEMM/386. The difference between the two is that while HI386 will give you the most memory, it is not as user friendly as QEMM (see Chapter 4, Memory Management section).

7.6.1. Installation. Installation of HI386 is a relatively simple process but it may require several re-installations in order to achieve optimum operation. Listed below are some general installation guidelines and highlights of HI386.

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a. Insert the first of two diskettes into the A drive of your PC and type INSTALL C: at the DOS prompt. HI386 automatically creates a directory called AMS onto the hard drive of the PC. The installation is menu driven and will instruct the user to load the remaining diskette into the AMS directory. HI386 automatically detects the areas available for high memory and makes amendments to the PC's Autoexec.bat file.

b. Run RYBSMEM.EXE. This will show users the size of the blocks available for use as high memory. The most desirable configuration will result with the largest block appearing as the last block. If this is not the result, reconfigure the LAN adapter card settings until the largest chunk of memory appears as the last block.

7.6.2. Documentation. HI386 comes with a READ.ME file which should be reviewed if any questions persist. Also contained in this file is information concerning how to gain access to the RYBS Bulletin Board system. This BBS can provide additional information not found within the READ.ME file.

7.7. SUMMARY. This chapter provided a general outline of network installation procedures and referred to the Banyan documents necessary to stand up a VINES network. Once network installation has passed the initial steps, it becomes a production system that has to be maintained as with any other computer system. It is important to keep all configuration worksheets and cabling diagrams in a centralized location. The worksheets and the cabling diagrams should be updated to reflect all changes made through the life cycle of the LAN. The next chapter, Network Management, outlines the duties of the administrators and provides detailed guidance necessary to effectively manage a VINES network.

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CHAPTER 8

NETWORK MANAGEMENT

8.1. NETWORK SECURITY.

8.1.1. Safeguards. Adequate safeguards must be implemented to protect sensitive information against accidental or intentional disclosure, modification, or destruction. This must be accomplished through the continuous employment of protective measures designed to ensure the integrity of the data, operating systems, software and all related resources. Physical security and access controls are the primary mechanisms used to safeguard a LAN and its many components. These controls must ensure that each network user is positively identified and authenticated, and that appropriate audit trails are maintained. Marine Corps Order P5510.14 provides the foundation for IS security and is applicable to any Marine Corps ADP system to include a LAN. Additional guidance can also be found in IRM-5239-10, Small Computer System Security Manual. The following are some guidelines for network security:

a. Each LAN user must be identified by a unique user ID and authenticated by the use of a personal password. The use of a group ID for more than one individual is prohibited.

b. Passwords will be at least 7 characters long, allowing any combination of alphabetic or numeric characters.

c. Users must keep their passwords confidential. The LAN administrator should be able to change user passwords, but be unable to obtain those passwords from the system.

d. Users should be required to change their password periodically to decrease the likelihood of it being compromised.

e. Users should be granted access to only those files and applications needed to perform their required duties.

f. All security administration functions should be separate from other network management and control duties. This will facilitate the auditing of security management functions within the network.

8.1.2. Security Logging. Information should be logged and maintained through the use of an audit system and protected so that actions affecting network security can be traced to the responsible party. The network must be able to record all occurrences of events related to security in an audit log. For each event recorded the audit log must identify the time, date, user involved, outcome of the event (success/failure) and origin of the request. The network should also have utilities that provide additional monitoring to further enhance security of the

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network. The log file should be printed and reviewed at least once a week. The log files should also be backed up and stored for at least three months

8.1.3. ARLS. In the Banyan VINES NOS, access to resources can be restricted to individual devices, directories and sub-directories, with control provided through the use of profiles. The restrictions available on resources are Control (full access), Modify, Read, and Null (no access). A user can only access a resource if it is specified in their user profile. Access to data will be granted, based on individual needs.

8.1.4. Physical Security. Access to servers will only be granted to authorized personnel. The location of servers should be designed to take advantage of secure areas of the work place. If a server is accessible after working hours, added precautions must be taken to prevent damage, destruction, and theft of the server. As a minimum, a lock out device should be installed to inhibit keyboard access.

8.1.5. Server Security. Security of the server console can be maintained by the use of a password. When the console is locked, only status displays and printer control can be accessed. The console password should be changed periodically and the console should never be left unlocked. There are default security settings that should be reviewed and set based on local requirements and resources. These settings MUST be changed from the default settings so users can NOT edit their own profiles. The console password should be at least seven alphanumerical characters in length and should be changed every ninety days.

8.2. SERVER OPERATIONS. There are many server operations that can be performed from the server console by the administrator. These operations fall into two categories; those you are likely to use daily and those you may need only on occasion. The types of operations that occur on a regular basis include checking the services that are running, maintaining security at the server console, backing up the information kept on the server, and managing server printers.

8.2.1. Services. To check the services running on the server you will need to display the service monitor, which is done by selecting "Display Service Status" from the Operator Menu. This will display all services on the server and their status. Note that the status of a service is automatically updated when it changes.

a. A service will be displayed in one of the following five states:

- (1) RUNNING - The service is available
- (2) STOPPED - The service is not available. To make

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it operational, a system administrator must start it.

(3) **INITIALIZING** - The service was recently started. When it becomes operational, the status will change.

(4) **INCONSISTENT** - The StreetTalk entry for this service cannot be located. This situation can occur if the StreetTalk group is on another server that is not currently active on the network. When the other server is started, the service will be restarted automatically. You restored a backup that was made before this service was created. Restore the service from a more recent backup, or delete and then recreate the service.

(5) **INOPERATIVE** - The service is not operating properly. An administrator should try to restart the service.

b. If a service remains inconsistent or inoperative, contact your Regional Representative (i.e., ISMO, RASC, etc.).

c. From the server console the administrator can stop and start all services using the "Shut Down Server Software" and "Restart All Services" commands. The last line on the Service Monitor Menu provides the following choices:

(1) **Refresh** - Updates the screen with the most current information.

(2) **Next Page** - Continues the display if it doesn't fit on a single screen.

(3) **Change Server** - Displays the Service Monitor for another server connected to your network.

(4) **Exit** - Displays the Operator Menu.

d. More information on server operations can be found in Chapter 2 of the VINES Server Operations Guide.

8.2.2. Backup Procedures. Each LAN Administrator (Network or Group) will be required to develop a backup strategy to ensure that all data on a network can be recovered in the event of a user error or a system error that could possibly delete data from the network.

a. There are two main considerations in developing an effective backup plan. First, you must provide adequate protection for the users of the server. You want to develop a strategy that will minimize the number of days work that can be permanently lost in the event of disk damage. Second, it is important that backups take place on a regular schedule.

b. An effective backup strategy begins with a complete

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system backup. It will copy the current status of all the server information, including VINES system and StreetTalk databases, system services, and user files. The frequency of the complete system backup is dependent upon server use. Weekly backups are recommended for servers with moderate-to-heavy use and monthly backups are a minimum for any server. The amount of information on the server will dictate the number of tapes or diskettes required to perform a complete backup.

c. Along with a complete backup the server should perform an incremental daily backup. This will record any changes on the server since the last complete or incremental backup, to include VINES and StreetTalk databases, system services and user files. This will take less time and often use only a single tape or a few diskettes, and will be especially helpful if you need to restore files that were accidentally deleted. A recommended backup schedule is as follows:

Sunday	-	Incremental
Monday	-	Incremental
Tuesday	-	Incremental
Wednesday	-	Incremental
Thursday	-	Complete
Friday	-	Incremental
Saturday	-	Incremental

d. After the daily backup has been completed these tapes or disks should be stored in a cool, dry secured area. Banyan strongly recommends that at least the three most recent complete backups be kept. These backups can be tested for damage by using the option "Confirming Readability of a Backup" on the BACKUP/RESTORE menu at the server console. Step by step backup procedures can be found in Chapter 4 of the VINES Server Operations Guide. If possible, backups should be stored in a secure container at a site that is different from the location of the network server.

8.2.3. Restore Procedures. If server information is lost due to user error or the server hard disk is damaged, you can restore it using the backups that have been created. There are several types of restore operations to use depending upon the type of information you want to restore and the type backup you have. If the tape or diskette contains a complete or incremental backup, the system displays the "Restore" menu at the system console. If the tape or diskette contains a service backup, it skips the menu and automatically selects the function, "Reload Selected Files". When an administrator restores only selected files it is called a "selective" restore. Complete procedures for system restores can be found in chapter 5 of the VINES Server Operations Guide.

8.3. SERVER REPORTING. The LAN system has various reporting capabilities which allow you to view and print information on users, and to track activities associated with the system and its

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services.

8.3.1. Report Utility. The "Report" utility provides a listing of StreetTalk database entries. You can choose to generate a report for a group or for an organization. An up-to-date hard copy of this report should be kept with your documentation and the Network Administrator should also be provided a copy. To generate this report, login as the administrator, type "Report" at the DOS prompt and press enter. After a menu appears select 1, "StreetTalk Naming System". This will prompt you with another menu which has several options. The option you will most likely use is #4, "Groups Maintained on a Particular Server". When you generate a report the system will save it on the disk; the administrator can then print the file or view it using the SCAN utility. The SCAN utility is used by typing "SCAN (filename.ext)" at the DOS prompt and pressing enter.

8.3.2. Operate and LOGGEN Utility. Other utilities available are OPERATE AND LOGGEN. These two utilities will create reports called Server Logs. The logs can be recorded in four levels of detail as follows:

- a. Level 0 - This is a report of general information, security violations and fatal errors.
- b. Level 1 - This contains more detailed general errors, Communications World Messages and recoverable errors.
- c. Level 2 - Resource usage and Debug information.
- d. Level 3 - High level Debug information.

Levels 0 and 1 are used by the administrator for troubleshooting. Levels 2 and 3 are normally used when there is required involvement by Banyan personnel. The level of detail is set in the OPERATE or LOGGEN utilities. Logs are recorded for each service on the server.

8.3.3. Logs. Here are some of those Logs and their functions:

- a. System Server Log - information on Console Operations, server power offs and startups, and any changes that have been made manually by the operator.
- b. Watchdog Log - reports on remote site connections including scheduled backups.
- c. Server Patch History - reflects any patches that have been installed on the server.
- d. File System Logs - contain the CKDISKLOG that provides bad block mapping information for the hard drives. This log also contains the FSCKLOG that reports on the general file system

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condition on the server boot.

e. Operating System Log - includes system error reports, any block asynch connects and disconnects, disk and tape errors (ADO, PTO) and time changes made automatically.

f. Server Service Log - keeps track of time synchronization.

g. VANGUARD Log - logs session monitoring activities and login validations.

h. StreetTalk Log - reports on timeouts, sessions, new networks that come on-line, and blast notifications.

i. Mail Service Log - this contains "resolve" errors and "Janitor" reports. If your server is pre-release 3.10 you may see "Bad Entry File" messages that originally were debug messages. It has been removed with release 3.10.

8.3.4 Error Messages. The server logs also provide a list of error messages, which can be printed to hard copy by using the "VNSERR" command at the DOS prompt. Other types of events are recorded in multiple logs, depending on what activity generates the event.

8.4. PERFORMANCE TUNING. Banyan has several utilities that are executed from a network workstation and can aid the administrator in assessing network performance.

8.4.1. Monitoring The Network. Proper tuning of the network requires that a number of factors be monitored and evaluated in relationship to each other. The following tools provide the capability to gather this data:

a. OPERATE - This utility provides the capability to display and control services, produce log reports, set server restrictions and to view server disk utilization.

b. MMAIL - This utility is a mail management function that allows the administrator to control the size of mail boxes and to control the mail service utilization.

c. MNET - This utility, formerly known as NETMAN, is an option that may be purchased and installed on each server. It will provide statistical information on the server performance and resource utilization.

8.4.2. Tuning The Network.

a. Use the Configure Server option on the server console whenever you are adding or changing a network card or a fixed disk on a server, configuring the file system (CACHE) or when

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configuring the communications limits (COMM BUFFERS).

b. Add Cards/Change Card Configuration is used for setting up a network card or fixed disk in the server. Refer to your Network Installation Guide for complete instructions.

c. The Configure File System function enables you to set file system cache limits and to turn bad block mapping on and off.

d. The Total Size of File System Cache is the amount (in kilobytes) of server memory that is used for caching frequently accessed data.

e. The Cache Buffer Size is the amount (in kilobytes) of server memory that makes up a cache buffer. The total file system cache is divided into cache buffers. The cache buffer size can be set at 2K, 4K or 8K.

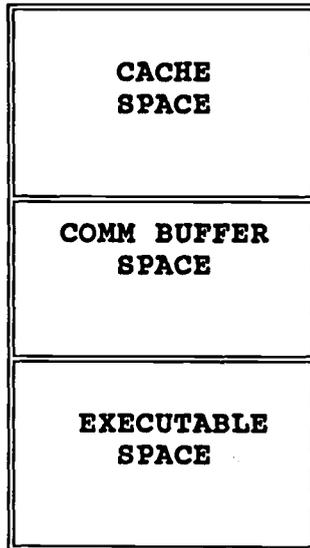
f. Bad Block Remapping is the process of detecting defective blocks on disks that have developed after initial formatting and marking these blocks so they can't be used.

g. Some of the server resources communicate with other nodes in the network. By using the Configure Communications Limits you can configure maximum limits for the resources the server uses to perform communications functions.

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h. The following diagram shows how VINES divides its RAM memory into three areas.



- File Service I/O Cache Space
Stores data from disk for quicker access passing through cache memory. Produces significant improvement in overall file service performance.

- Communications Buffer Space
Temporary queuing space needed for Network Data Packets. All data going out or into the server passes through the communications buffer.

- Executable Space
UNIX
Communications Drivers
"Running" Services

i. After the executable memory space has been assigned the remaining RAM is divided between Comm Buffers and File Cache. Comm Buffers will default to 60 kilobytes and the remaining RAM will be assigned to the File Cache. In the CNS and VINES 386 servers with 4MB of physical memory, the total File Cache Size is 400KB. If the physical memory is more than 4MB, 75% of memory over 4MB goes to cache. The exact amount of memory required varies slightly, based on the hardware platform and the version of VINES running on that platform. Use figure 8-01 to determine your exact memory requirements when configuring your Banyan servers with VINES 4.00. Use figure 8-02 if you are running VINES 3.00.

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AVERAGE MEMORY UTILIZATION (4.00)

Required System Software	CNS	VINES 386
StreetTalk, Server Service, VanGuard Z:Drive, UNIX Memory Reserve	2670K	2870K
User Configurable Services		
File Services	60K	60K
Mail	410K	410K
Print (1st)	260K	260K
Print (additional)	100K	100K
Asynch	150K	150K
Tools (compiler)	460K	460K
MNET	110K	110K
SNA (1st)	150K	150K
SNA (additional)	75K	75K
NetBIOS (1st)	100K	100K
NetBIOS (additional)	50K	50K
Driver Options		
TCP/IP	68K	68K
LAN Driver (per card), including ICA	16K	16K

FIGURE 8-01

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AVERAGE MEMORY UTILIZATION (3.00)

Required System Software	CNS	VINES 386
StreetTalk, Server Service, VanGuard UNIX Memory Reserve, VINES Files.	2884K	2968K
User Configurable Services		
Additional File Services		
Mail	92K	100K
Print (1st)	404K	428K
Print (additional)	360K	400K
Asynch	212K	248K
Tools (compiler)	224K	232K
MNET	700K	772K
NetBIOS (1st)	176K	182K
NetBIOS (additional)	148K	156K
SNA (1st)	76K	84K
SNA (additional)	164K	172K
	80K	88K
Driver Options		
TCP/IP	68K	68K
LAN Driver (per card), including ICA	16K	16K

FIGURE 8-02

j. The following steps should be performed by the Group Administrator on a routine basis to ensure that the LAN remains operational without interruptions:

(1) Login and monitor the time lapse from entry of the user password until the user profile is displayed. This measurement is useful in indicating performance problems.

(2) Use the OPERATE command to verify that all services are running.

(3) Check the total percentage of storage space allocated, which should never exceed 85%.

(4) Run MNET (NETMAN) to verify that all communications links are operational and that there are no excessive errors occurring on the interface lines, both LAN and Server-to-Server.

(5) Check the 1, 5 and 15 minute CPU averages. The 1 minute average should never rise above 65% for any length of time. The 15 minute average should be no more than 50%. Usage above this range should be noted, monitored and reported to the Network Administrator.

(6) Disk and Mail utilization should be checked periodically.

k. Due to the complexity of the NOS, constant monitoring and recording of network statistics will allow the administrator

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to gain a more thorough understanding of network functions and will provide a better foundation for the resolution of performance problems.

1. Listed below is Banyan's recommended Tuning Methodology:

- (1) Start with the defaults.
- (2) Start all regularly used services on the server.
- (3) If Comm Buffer runs above 30%, increase the size in increments of 30K.
- (4) If SWAVG is greater than .1, decrease the total cache size in increments of 100K.
- (5) If SWAVG is always .00, increase total cache size in increments until it is >.00, then back it down one.
- (6) If resulting Cache Hit Rate is below 75%, increasing the total memory size in the server would make a noticeable improvement.

8.4.3. Troubleshooting.

a. Managing a network means controlling its inventory, configuration, maintenance/performance, troubleshooting and problem resolution. Management approach is based on needs, network size, and distributed or centralized implementation. To maintain the network's performance and operation, use the VINES OPERATE, MNET and REPORT programs. To identify faulty components, use the VINES PC and/or server diagnostic programs and the appropriate hardware vendor's diagnostics. The following is a list of Banyan recommended guidelines for troubleshooting network problems.

(1) SERVER LOAD AVERAGES are exponential decaying averages. It is the average number of user-related services requesting to run to a server during a one minute period, five minute period and fifteen minute period. The one minute load should not exceed 1.0 for a prolonged duration and the average should not be more than 0.6 per fifteen minute period.

(2) MESSAGE AVERAGE is a one minute average of messages sent and received by a server per second. A message results from service related interaction with other servers and is generated by the applications using the VINES services. It is a snapshot of the last minute of activity. The average should not exceed 40.0 in a 24 hour period.

(3) "DROPS" are messages accepted from the LAN but not accepted by buffer because it was full. The drop count should not be more than 5K per day or 1K per hour.

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(4) SWAP AVERAGE (SWAVG) indicates the average number of process swaps (per second) per one-minute period. An acceptable average is below 0.1. If the average exceeds 0.3, take corrective action.

(5) VINES monitors activity of each disk on the server.

(a) Averages are cumulative since the last time the option was selected.

(b) Requests are the total number of "program" requests to use the disk, blocks read or written (if you divide blocks by requests, you get the average number of blocks transferred per request).

(c) Utilization is the 5 minute Exponential Decaying Average percentage of time the disk unit was actually in use transferring data.

(d) Demand is the 5 minute Exponential Decaying Average of the amount of time the disk needed to be in use to satisfy all of the requests. Demand can be greater than utilization and will be whenever there are multiple requests for the same disk unit. Simply, this indicates that more than one service is using the disk. Demand can exceed 1.0 (100%) indicating that not all of the requests in the interval could be serviced in the interval. By reconciling high utilization and demand figures with known or suspected file access problems, you can balance the load on the disks to achieve better performance.

b. The file system statistics tracked for a server are:

(1) Maximum number of open files - max number of files that have been opened at one time.

(2) Maximum number of opens on files - the most simultaneous opens on files.

(3) Percentage of cache hits - the percentage of requests for cache buffers that were serviced by existing cache buffers, not requiring access to the physical disk.

(4) Number of times unavailable - number of times that a clean buffer was not available when a cache buffer allocation was requested. A cache buffer is clean when it has no data to be written to it.

c. Communication statistics reflect network communications activities:

(1) Communications buffer size - the amount (in kilobytes) of server memory used for network communications.

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(2) Communications buffer use - the percentage of the total comm buffer size currently in use.

d. Certain conditions, such as LAN noise or heavy traffic, can make buffer use jump quickly into the 90% range or higher. Comm buffers that are requested, but can not be allocated, result in drops. Comm buffer use between 20% and 35% is typical of a server that is fully loaded and very busy...but healthy. If use is 50% or more, the server may not be able to handle peak loads or transient network errors without causing drops and performance degradation.

(1) Number of SPP (Sequenced Packet Protocol) connections configured for the survey.

(2) Maximum number of concurrent SPP connections currently in use.

(3) Maximum number of open sockets in use.

(4) Maximum number of sockets configured to concurrently open on this server.

e. VINES collects performance data for each interface supported by a server. Each VINES server also supports VINES IP (Internet Protocol), which is not a genuine network interface, but a pseudo-interface within the server. VINES IP is a layer above the actual network interfaces, but it is shown as an interface because its statistics are important for understanding the server's behavior. The server's performance is affected by routing/relaying the traffic VINES IP processes. Gateway servers support additional loads. VINES IP interface statistics include total number of VINES IP packets received and sent, packets received with invalid checksum, broadcast packets sent, packets fragmented and concatenated, and packets sent and received from IP protocol on the server. It is the largest number of packets routed in one second (since server was last booted). Note that "routed" means a packet was received from the local LAN, but was not destined for a service on this server. As guidelines (in terms of total packets routed), a stand-alone server should be between 0-5%, a backbone server should be between 5-15%, and a gateway server should be between 15-70%.

8.4.4. Troubleshooting Guidelines. Below is a list of error conditions to watch for during the operation of your network.

15min server load average	>60% consistently
MsgAvg	>40% consistently
SWAVG	>10% consistently
Dops	Increasing Rapidly
Comm Buffer Use	>35% consistently
Cache Hits	<75% consistently
Routing %	>Typical Range for Server Use

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Disk Usage	>90% consistently
Disk Demand	>100% consistently
Disk Capacity	Approaching Maximum
LAN Interface Errors	Increasing Rapidly
Disk ADO Errors	>0
Service Unavail/Crashing	Often

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Appendix A

GLOSSARY

ACKNOWLEDGE - A station "acknowledges" a received frame when it transmits the appropriate frame(s) indicating the received frame has been received with no errors.

ADDRESS - The location of a terminal, a peripheral device, a node, or any other unit or component in a network.

APPLICATION SERVER - A network device that houses shared applications and common-use file space.

APPLICATION SOFTWARE - Programs that perform useful functions in the processing or manipulation of data; includes database managers, word processors, spreadsheets, telecommunications, desktop publishers, and other programs that manipulates data.

ARCHITECTURE - A set of standards used as the basis for design and implementation of a user application network. The use of a common architecture allows compatibility between similar systems for document interchange, communications, etc.

ASCII - American Standard Code for Information Interchange. This is a 7-bit plus parity code established by ANSI to achieve data services compatibility. Also called USASCII.

ASYNCHRONOUS - Asynchronous transmission implies independent signal clocking at the transmit and receive ends of the communication line, between the terminal and computer.

BACKBONE NETWORK - A transmission facility designed to inter connect low-speed distribution channels or cluster of dispersed user devices.

BANDWIDTH - The range of frequencies assigned to a channel or system, as used in Data Communications.

BASEBAND SIGNALING - Transmission of a signal at its original frequencies, without modulation.

BAUD RATE - A measure of signaling speed equal to the number of discrete conditions or signal events per second.

BAUDOT CODE - A code for the transmission of teleprinter data, in which five bits represent one character. Still used in paper-tape messages aboard ship.

BINARY SYNCHRONOUS COMMUNICATIONS (BSC) - A half-duplex, character oriented synchronous data communications protocol.

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BIT - The smallest unit of information in the binary system of notation.

BLOCK - A group of characters transmitted as a unit, over which a coding procedure is usually applied for synchronization and/or error control purposes. OSI term for the same entity is a "FRAME."

BREAK - A long space on an asynchronous communications line that is intended to alert the receiving terminal. Minimum duration is one character time.

BRIDGE - Equipment which allows the intercommunication of networks, allowing communication between devices on separate networks using similar protocols.

BUFFER - A temporary storage device used to compensate for the difference in the rate of data flow when transmitting data from one device to another.

BUS - A network topology which functions like a single line and is shared by a number of nodes.

BYTE - A sequence of consecutive bits operated upon as a unit, usually used to refer to an 8-bit segment.

CACHE - Computer memory that is used to "store" frequently used data.

CARRIER SENSE MULTIPLE ACCESS WITH COLLISION DETECTION (CSMA/CD) - A connection technique which allows multiple stations to successfully share a broadcast channel by avoiding contention via carrier sense and deference, and managing collisions via collision detection and packet retransmission.

CHANNEL - A path for electrical transmission. Also called a circuit, facility, line link, or path. A specific and discrete bandwidth allocation in the radio frequency spectrum (for example, in a broadband LAN) utilized to transmit one information signal at a time.

CIRCUIT - A communications path between two points.

CLIENT - A workstation on the network that requests services from a centrally located applications server.

COLLISION - Overlapping transmissions which occur when two or more nodes attempt to transmit at or about the same instant. Their interference is a collision.

COMMUNICATION ACCESS METHOD - Software which serves as the interface between physical communication lines and logical program functions. (VTAM, TCAM, and BTAM are IBM communication

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access methods.)

COMMUNICATIONS BUFFER (COMM BUFFER) - Temporary queuing space for Network Data Packets. All data going into or out of the server passes through the Comm Buffer.

COMMUNICATIONS CHANNEL - A way to send and receive data.

CONCENTRATOR - A communications device that provides communication capability between many low-speed channels and one or more high-speed channels.

CONDITIONING - The addition of equipment to leased voice-grade lines so as to provide specified minimum values of line characteristics required for data transmission.

CONNECTIVITY - A general term used to refer to communications outside the LAN.

CONTENTION - A "dispute" between two or more devices over the use of a common channel at the same time.

CONTROL CHARACTER - A character whose occurrence in a particular context initiates, modifies, or stops a control function.

DATA SET - (1) A modem; (2) a collection of data records with a logical relation of one to another.

DATA TERMINAL EQUIPMENT (DTE) - The equipment comprising the data source, data sink, or both.

DCA - Document Content Architecture.

DDN - Defense Data Network. The DOD standard network. The Marine Corps has been granted a temporary waiver from mandatory use of DDN. (See MCDN)

DEMODULATION - The process of retrieving and digitizing an original intelligence signal from a modulated (analog) carrier wave.

DISOSS - Distributed Office Support System. The central program in the IBM office system. Installed on the mainframe computer in order to add E-mail, file transfer, and host document library services to MCDN.

DISTRIBUTED INFORMATION SYSTEM - A coordinated set of information-processing capabilities implemented in two or more physically separated resource centers, such as computer sites or terminal locations. This is commonly shortened to Distributed System.

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DISTRIBUTED PROCESSING - (1) A technique for implementing a set of information processing functions within multiple physically separated physical devices; (2) a single task divided into a series of sub-tasks, which are processed by separate equipments communicating with each other.

DUPLEX-FULL/HALF - In full duplex, data can be transmitted in both directions at the same time. In half duplex, data can only be transmitted in one direction at a time.

ELECTRONIC MAIL (E-MAIL) - Network software that allows users to send messages and files to other network users.

ELMS - The Marine Corps Electronic Library and Mail System serves as the backbone network for LAN connectivity. ELMS is the application of IBM's DISOSS software, installed on mainframe computers connected through MCDN.

END-USER - The operator on the work station that is attached to the network.

ETHERNET - A baseband local area network specification developed jointly by Xerox Corporation, Intel Corporation, and Digital Equipment Corporation to interconnect computer equipment using coaxial cable and "transceivers".

FEP - Front End Processor. A mini-computer used to off-load a host from much of the work of managing a communications network. Usually connected over a channel to the host.

FIBER OPTIC CABLE - Cable that uses light instead of electrons to transmit data. Provides a faster, more secure communications path than metal-based cabling.

FILE SERVER - A network device that normally houses the Network Operating System and common-use file space.

FILE SHARING - A feature on most networks that allow multiple users to access the same file space.

FRAME - The unit of information generated by the Level 2 protocol of X.25 that comprises an address field, a control field, a frame check sequence and (in information frames only) an information field.

GATEWAY - The point of connection between two dissimilar communication systems, for example between a local area network (LAN) and a packet-switching network or between two PSNs.

GROUP - In a LAN environment, a group is a logical combination of related users and network resources. A group is usually located in a single building, ship, or perimeter. Groups are defined within the StreetTalk database as part of an organization.

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GROUP ADMINISTRATOR - The first level of network administration.

HALF-DUPLEX - Transmission in either direction, but not both directions simultaneously.

HAND SHAKING - The exchange of predetermined signals for purposes of control when a connection is established between two data sets.

HIGH MEMORY - The memory above 640KB.

HOST COMPUTER - A computer attached to a network primarily providing services such as computation, database access special programs, or programming languages.

HUBS - Devices that are used in Arcnet topology for connecting workstations to the network.

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE) - A committee that sets standards for the interconnection of local and networking computer equipment.

INTERNATIONAL STANDARD ORGANIZATION (ISO) MODEL - A standard approach to network design which introduces modularity by dividing the complex set of functions into more manageable, self-contained, functional slices.

LAN ADMINISTRATOR - The administrator who manages one or more network sites.

LEASED LINE - A line reserved for the exclusive use of a leasing customer. Also called private line.

LOCAL AREA NETWORK (LAN) - A system that connect computers together within a restricted geographical area.

MCDN - Marine Corps Data Network. Central network consisting of circuit-switched lease lines, Network Control Program (NCP), and mainframe computers.

MODEM - Modulator-demodulator. A device that modulates and demodulates signals. Primarily used for modulating digital signals onto carriers for transmission and for performing the inverse function at the receiving end; modems are essential for transmitting and receiving digital signals over voice-grade analog telephone lines.

MSAU (MULTISTATION ACCESS UNIT) - A wiring concentrator used with most Token Ring LANs.

MULTIPLEX - The concurrent transmission of more than one information stream on a single channel.

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MULTIPOINT CIRCUIT - A circuit interconnecting several locations, where information transmitted over the circuit is available at all locations simultaneously.

NETBIOS - ISO session-level interface to the IBM PC Network and the IBM Token Ring Network.

NETWORK - A group of computer devices connected by a communications path.

NETWORK ARCHITECTURE - Defines system components, functions that these components perform, and their interrelationships. A specification which defines how the system is to be organized, defining functional modularity as well as protocols and interfaces which allow communication and cooperation among those modules.

NETWORK INTERFACE CARD (NIC) - Electronic circuitry that connects a workstation to a network.

NETWORK OPERATING SYSTEM (NOS) - The operating system that runs the Network.

NETWORK SERVICE - A resource or application available through the server.

NODE - Generic name for a packet switch. A point in the network where one or more communication lines terminate. Nodes can be of two kinds: (1) intermediate nodes whose basic function is to switch network-protocol data units from one data link to another data link; (2) end nodes providing the network-connection-endpoints. A node can be simultaneously an intermediate node and an end node.

ORGANIZATION - In a LAN environment, an organization consists of related groups. This is the highest level of names on the network. Organization names refer to structural areas of the network such as Area 13, Camp Geiger or the Command Operations Center (COC).

PACKET - A collection of bits that contain both control information and data. The basic unit of transmission in a packet-switched network, control information is carried in the packet, along with the data, to provide for such functions as addressing, sequencing, flow control, and error controls at each of several protocol levels. A packet can be of fixed or variable length, but generally has a maximum length.

PACKET SWITCHING - A data communications technique in which data is transmitted by means of addressed packets and a transmission channel is occupied for the duration of transmission of the packet only. The channel is available for use by packets being transferred between different data terminal equipment.

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PACKET ASSEMBLER/DISASSEMBLER (PAD) - An interface device which buffers data sent to/from character node devices and assembles and disassembles the packets needed for X.25 operation, an extension of CCITT X.25.

PARITY CHECK - Addition of non-information bits to data, making the number of ones in each grouping of bits either always odd for odd parity or always even for even parity. Used for error detection purposes.

PHYSICAL TOPOLOGY - The physical layout or arrangement of devices and links.

POINT-TO-POINT Transmission - Transmission of data between only two stations or nodes, i.e., one sender and one receiver.

POLLING - The process of inviting another station or node to transmit data.

PORTS - A named gateway (to or from an entity) that looks like an I/O device. A port uniquely identifies an entity and a function within it. Session originators specify a port name as part of the session request.

PROTOCOL - A formal set of conventions or rules governing the format, timing, and error control to facilitate message exchange between two communicating processes.

RASC - Regional Automated Service Center. Regional node for MCDN as well as support facility for all subordinate activities within the assigned region.

RESPONSE TIME - The amount of time elapsed between a generation of an inquiry at a terminal and receipt of a response at that same terminal.

REVISABLE-FORM-TEXT - DCA-RFT documents can be edited by users. In addition to their content, DCA-RFT documents contain formatting parameters that define the page layout. (For example; margins, indentation, and page numbering.)

REPEATER - For local area networks, a device which increases the signal cover of a single LAN segment by joining it to another, so that packets sent on one segment can be "repeated" (or copied) onto the other, increasing the local environment.

RING - A network topology in which stations are connected to one another in a closed logical circle. Typically, access to the media passes sequentially from one station to the next by means of polling from a master station, or by passing an access token from one station to another.

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ROUTER - A Network device that examines data addressing; determines the most efficient pathway to the destination, and routes the data accordingly.

RS-232-C - A technical specification published by the EIA that specifies the mechanical and electrical characteristics of the interface for connecting DTE and DCE. The standard applies to both asynchronous and synchronous serial, binary data transmission at speeds up to 20 Kbps in full or half-duplex mode. RS-232-C defines 20 specific functions. The physical connection between DTE and DCE is made through plug-in, 25-pin connectors.

RS-449 - Another EIA standard for DTE/DCE connection which specifies interface requirements for expanded transmission speeds (up to 2 Mbps), longer cable lengths, and 10 additional functions. RS-449 applies to binary, serial, synchronous or asynchronous communications. Half-duplex and full-duplex modes are accommodated and transmission can be over 2-wire or 4-wire facilities such as point-to-point or multipoint lines. The physical connection between DTE and DCE is made through a 37-contact connector; a separate 9-contact connector is specified to service secondary channels interchange circuits, when used.

SERIAL INTERFACE - An interface which requires serial transmission of the transfer of information in which the bits composing a character are sent sequentially. Implies only a single transmission channel.

SERVER - A processor which provides a specific service to the network. Examples of servers are as follows: routing server - connects nodes and networks of like architectures; gateway server - connects nodes and networks of different architectures by performing protocol conversions; and terminal server, printer server, and file server - provides an interface between compatible peripheral devices on a LAN.

SESSION - (OSI RM) (1) A cooperative relationship between two application-entities characterizing the communication of data between them; (2) the period of time during which a user of a terminal can communicate with an interactive system: usually the elapsed time from when a terminal user logs on the system until he logs off the system; (3) the period of time during which programs or devices can communicate with each other; (4) in SNA, a logical connection established between two network addressable units (NAUs) which allows them to communicate. The session is uniquely identified by a pair of network addresses, identifying the originating and destination NAUs of any transmissions exchanged during the session; (5) a formal binding of two cooperating end-users in a network so that they may communicate with each other.

SIMPLEX MODE - Operation of a channel in one direction only with no capability of reversing.

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SITE-SPECIFIC PATCH - These are patches to the NOS that fix a small number of problems.

SNADS - SNA Distribution Services. An extension of the Standard Network Architecture (SNA), SNADS controls asynchronous communication between nodes (junctions). It is a document delivery system that defines a store-and-forward network. As data moves through the SNADS network, it may be queued, allowing for alternate document paths during network interruptions. SNADS can be used to distribute documents, data bases, software or other electronic data.

STAR - A network topology consisting of one central node with point-to-point links to several other nodes. Control of the network is usually located in the central node or switch, with all routing of network message traffic performed by the central node. Each station communicates with all other stations through the central node, potentially creating a central point of failure.

START BIT - In asynchronous transmission, the bit which synchronizes the receiver clock to the receiving data, done at each received character. The start bit is always a space.

STOP BIT(s) - In asynchronous transmission the bit(s) which terminate the character frame, always a Mark, so that a start bit will be clearly recognized on a mark-to-space transition.

STORE-AND-FORWARD - The process of message handling used in message switching systems in which messages are temporarily stored and then forwarded.

SYNCHRONOUS DATA LINK CONTROL (SDLC) - An IBM developed bit-oriented, synchronous data link layer communications protocol which specifies the discipline for managing synchronous, transparent, serial-by-bit information transfer over a communication channel. Transmission exchanges may be duplex or half-duplex over switched or non-switched data links. The communication channel configuration may be point-to-point, multipoint, or loop. Contrast with binary synchronous transmission and start-stop transmission.

SYSTEMS NETWORK ARCHITECTURE (SNA) - IBM's layered transmission protocol for data communications among IBM computers and terminals. The total description of the logical structure, formats, protocols, and operational sequences for transmitting information units through the communication system. Communication system functions are separated into three discrete areas: the application layer the function management layer, and the transmission subsystem layer. The structure of SNA allows the ultimate origins and destinations of information (i.e., the end-users) to be independent of, and unaffected by, the specific communication system services and facilities used for information

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exchange.

SWAVG (SWAP AVERAGE) - When all the services that are currently active do not fit into RAM, the server must swap services or parts of services between memory and disk.

TCP/IP (TRANSMISSION CONTROL PROTOCOL/INTERNET PROTOCOL) - A layered set of protocols that allows sharing of applications among PCs in a high-speed communications environment.

THROUGHPUT - The total useful information processed or communicated during a specified time period. Expressed in bits per second or packets per second.

TOKEN RING - A network using the token-passing protocol and a ring topology.

TOPOLOGY

1. **Physical topology** - The configuration of network nodes and links. Description of the physical geometric arrangement of the links and nodes that make up a network, as determined by their physical connections.

2. **Logical topology** - Description of the possible logical connection between network nodes, indicating which pair of nodes are able to communicate, whether or not they have direct physical connection. Examples of network topologies are:

- a. Bus
- b. Ring
- c. Star
- d. Tree

VOICE-GRADE CHANNEL - A channel used for speech transmission usually with an audio frequency range of 300-3300 Hertz. Called Type 3002 circuit by AT&T.

WIDE AREA NETWORK (WAN) - A system allowing transfer of all data communications between LANs.

X.25 - Defines the interface between a DTE and a DCE for packet-mode operation on a Public Data Network (PDN).

3270 EMULATOR - Software which allows programs on a computer system to communicate interactively with application programs on an IBM mainframe. So called because the programs act as "virtual" users of IBM 3270 interactive terminals.

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Appendix B

BANYAN MODEL NUMBERS

This appendix provides information that you should refer to when looking for the BANYAN product model number.

CORPORATE NETWORK SERVER (CNS)

CNS 386 SYSTEMS - Comes standard with 25 MHZ i386 processor, 32 KB of RAM cache Base System VINES Software and Documentation

<u>MODEL NUMBER</u>	<u>OPTION</u>
CNS22C	4 MB of Memory 80 MB of Disk
CNS44C	8 MB of Memory 146 MB of Disk
CNS54C	8 MB of Memory 320 of Disk
CNS64C	8 MB of Memory 660 MB of Disk

CNS 486 SYSTEMS - Comes standard with 25 MHZ i486 processor 8 KB of On-Chip cache 8 MB of Burst-Mode Memory Base System VINES Software (4.0) and Documentation

<u>MODEL NUMBER</u>	<u>OPTION</u>
CNS44D	146 MB of Disk
CNS54D	320 MB of Disk
CNS64D	660 MB of Disk

ADD-ON SOFTWARE OPTIONS

<u>MODEL NUMBER</u>	<u>OPTION</u>
PA100	Network Mail
NA100	PC Dial-In
NM130	Network Management
PCP100	PC Network Printing
SNA100/286	3270/SNA Emulation for VINES 286, 16 Session
SNA100	IBM 3270/SNA (32 Session)
SNA101	IBM 3270/SNA (64 Session)
SNA102	IBM 3270/SNA (96 Session)
SNA200	Advanced IBM 3270/SNA (32 Session)
SNA201	Advanced IBM 3270/SNA (64 Session)
SNA202	Advanced IBM 3270/SNA (96 Session)
SNA300	Advanced IBM 3270/SNA (GRAPHICS -- 32 Session)
SNA301	Advanced IBM 3270/SNA (GRAPHICS -- 64 Session)
SNA302	Advanced IBM 3270/SNA (GRAPHICS -- 96 Session)
BSC100	IBM 3270/BSC (32 Session)

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BSC101	IBM 3270/BSC (64 Session)
BSC102	IBM 3270/BSC (96 Session)
TCP100	TCP/IP Routing
TCP200	TCP/IP Server-To-Server
IM100	LAN Server-To-Server
IM101	WAN Server-To-Server
PDN100	X.25 Server-To-Server
HA201	X.29
MAC100	MacVINES Mail Gateway
MAC200	MacLAN Connect
TRB100	Token Ring Bridging
MGW110	SMTP Mail Gateway
VDT100	Application Toolkit
HA101	Asynchronous Terminal Emulation with Kermit Transfer
TCP120	PC/TCP Server Based License
TCP110	PC/TCP Server Based License W/Routing
TCP121	PC/TCP Server Based License (Ethernet only)
TCP111	PC/TCP Server Based License W/Routing (Ethernet only)

BANYAN DOCUMENTATION GUIDE MANUALS

<u>MODEL NUMBER</u>	<u>MANUAL NAME</u>
DA201	Serial Communications Installation Guide
DA202	Network Management Option Guide
DA203	Network Installation Guide for VINES 286/386 Servers
DA204	User's Guide
DA205	Server Operations Guide
DA206	Administrator's Reference
DA207	Administrator's Planning Guide
DA208	Network Mail Option Guide
DA209	PC Dial-In Option Guide
DA212	TCP/IP Option Guide
DA213	Network Installation Guide for BANYAN/CNS
DA120	Network Installation Guide for BANYAN/BNS
DA121	Network Installation Guide for BANYAN/DTS
DA219	External Tape Drive Option Installation Document
DA220	Guide to BANYAN Publications
DA181	3270/SNA Option Guide
DA182	3720/BSC Option Guide
DA183	Asynchronous Terminal Emulation Option Guide
DA184	X.25 Option Guide
DA185	UPS Option Guide
DA190	20-Line Serial Communications Option Installation Guide
DA191	EXP-DTS Option Installation Document
DA192	BNX Option Installation Document
DA232	MacVINES Mail Gateway Administrator's Guide
DA233	MacVINES Mail Gateway User's Guide

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DA241	SMTP Gateway Option Guide
DA140	BANYAN Network Server Field Service Manual
DA141	Programmer's Interface (DOS)
DA142	Architecture Definition
DA150	Applications Directory
DA151	Hardware Maintenance Manual for the BANYAN DTS 100/200
DA223	CNS Hardware Maintenance Manual
DA224	Application Developer's Guide and Reference
DA225	Application Developer's Programming Interface

SERVER HARDWARE OPTIONS

<u>MODEL NUMBER</u>	<u>OPTION</u>
ICA108	6 Port Serial ICA
ICA210	6 Port Micro Channel ICA
EXT106	60 MB Tape Drive for VINES 286/386
EXT115	150 MB Tape Drive for VINES 286/386
EXT215	150 MB Tape Drive for Micro Channel
EXT322	2.2 GB Tape Drive for CNS Servers

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Appendix C

BANYAN PUBLICATIONS

This appendix provides a list of BANYAN publications.

VINES Network Installation Guide
BANYAN Applications Directory
BANYAN Platform Certification Program Notices
Guide to BANYAN Publications
VINES User's Guide
Network Installation Guide BANYAN/CNS Servers
VINES Serial Communication Installation Guide
VINES LAN Documentation Set
VINES Network Mail Option Guide
VINES Network Management Option Guide
Network Installation Guide for VINES 286/386 Servers
Server Operations Guide
Administrator's Reference
Administrator's Planning Guide
PC Dial-In Option Guide
TCP/IP Option Guide
Network Installation Guide for BANYAN/BNS
Network Installation Guide for BANYAN/DTS
External Tape Drive Option Installation Document
3270/SNA Option Guide
3720/BSC Option Guide
Asynchronous Terminal Emulation Option Guide
X.25 Option Guide
UPS Option Guide
20-Line Serial Communications Option Installation Guide
EXP-DTS Option Installation Document
BNX Option Installation Document
MacVINES Mail Gateway Administrator's Guide
MacVINES Mail Gateway User's Guide
SMTP Gateway Option Guide
BANYAN Network Server Field Service Manual
Programmer's Interface (DOS)
Architecture Definition
Applications Directory
Hardware Maintenance Manual for the BANYAN DTS 100/200
CNS Hardware Maintenance Manual
Application Developer's Guide and Reference
Application Developer's Programming Interface
StreetTalk Directory Assistance Guide
Software Option Guide

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Appendix D

LAN PLANNING FORMS

This Appendix contains forms that will aid network planners in setting requirements and estimating costs for new networks.

The forms listed below are included in this Appendix.

WORKSTATION REQUIREMENTS FORM

WORKSTATION PROCUREMENT SUMMARY

SERVER REQUIREMENTS FORM

LOCAL AREA NETWORK REQUIREMENTS SUMMARY FORM

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WORKSTATION REQUIREMENTS FORM

PAGE: 1 of 1	DATE: ___/___/___																						
Section A: NEW WORKSTATIONS If no workstation is available and needs to be procured, check box and proceed to Sections C, D, E, and F. <div style="float: right; border: 1px solid black; width: 50px; height: 30px; margin-top: 5px;"></div>																							
Section B: EXISTING WORKSTATION UPGRADES CPU Make _____ Serial # _____ Memory (512KB required; 640 recommended) Memory Upgrade 512KB to 640KB Memory Upgrade - 1MB or greater Hard Disk (minimum 20MB recommended) Floppy Disk-5.25"/1.2MB DOS Upgrade (3.2 or greater recommended) Surge Protector Optional: Mouse (9-pin serial port required) 9-pin serial port Color monitor & graphics card Math Co-processor	<table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;"><u>AVAILABLE</u></th> <th style="text-align: left; border-bottom: 1px solid black;"><u>PROCURE</u></th> </tr> </thead> <tbody> <tr><td>_____</td><td>_____</td></tr> </tbody> </table>	<u>AVAILABLE</u>	<u>PROCURE</u>	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
<u>AVAILABLE</u>	<u>PROCURE</u>																						
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_____	_____																						
Section C: PERIPHERALS Printer _____ Tape backup unit - minimum 20MB recommended																							
Section D: COMMUNICATIONS REQUIREMENTS Indicate present and additional host connectivity: Host: 1. _____ 2. _____ 3. _____																							
Section E: APPLICATIONS REQUIRED Indicate if user has requirement for: Enable _____ Harvard Graphics _____ Other _____																							
Section F: ORGANIZATION DESCRIPTION Workstation POC _____ Phone _____ Dept/Location/Bldg _____ Room _____ Additional comments:																							

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WORKSTATION REQUIREMENTS FORM - INSTRUCTIONS

The Workstation Requirements Form is provided to assist in the collection and summarization of workstation hardware/software requirements to support LAN connectivity. One of these forms should be filled out for each workstation that will be connected to the LAN.

Section A: NEW WORKSTATIONS

Organization management should determine that activities of a particular position are of sufficient scope and volume to justify the acquisition of automation tools. If the computing resources requirements of the position justify a workstation and one is not available, check the box in Section A.

A standard workstation configuration, as determined by the RASC/ISMO, will be procured. Proceed to Section C and complete the remainder of the form.

Section B: EXISTING WORKSTATION UPGRADES

To ensure compatibility, Section B must be completed for every existing workstation that will have LAN connectivity. Components that may be required to meet functional requirements for a workstation are listed in the left hand column. Place an "X" in the AVAILABLE column for each component that meets the standard requirements. If the component needs to be purchased, place an "X" in the PROCURE column.

Enter the type of CPU beside CPU MAKE. Record the serial number of the CPU beside SERIAL #. Most serial numbers can be found on the back side of the CPU casing.

Section C: PERIPHERALS

Peripherals refer to existing or additional devices required to service the workstation. Identify the printer if one is available on the existing workstation. In most cases, new workstations should not have the need for a desktop printer. In a LAN environment, peripherals, such as laser printers, may be shared by several workstations. Requirement for tape backup facilities should be based on security and criticality of applications associated with the workstation. Indicate the type and quantity of peripherals required in the appropriate spaces.

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Section D: COMMUNICATION REQUIREMENTS

Section D refers to specific communications connections required to provide desired connectivity of the workstation to specific host computers. Provide a host name and place an "X" under the "AVAILABLE" column to indicate the mainframe computer(s) the workstation currently accesses or indicate any additional connectivity requirements by placing an "X" under the appropriate "PROCURE" column.

Section E: APPLICATION REQUIRED

CMC message R28031Z Nov 89 recommends that Enable OA and Harvard Graphics become the Marine Corps standards for microcomputer office automation applications. Both of these software packages are LAN compatible and fully operational on a BANYAN VINES network. Indicate if each user requires these software applications.

Section F: ORGANIZATION DESCRIPTION

Section F is used to provide information about the requesting organization, the workstation point of contact, and the proposed location of the workstation.

Additional Comments may be used to record any specific requirements or notes that supplement the information provided on the form.

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WORKSTATION PROCUREMENT SUMMARY

PAGE: 1 of 1	DATE: ___/___/___																																	
Section A: NEW WORKSTATIONS Enter the total number of boxes checked in Section A on all WORKSTATION REQUIREMENTS FORMS	<table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:33%;">NUMBER TO PROCURE</td> <td style="width:33%;">ESTIMATED UNIT COST</td> <td style="width:33%;">ESTIMATED TOTAL COST</td> </tr> <tr> <td align="center">x</td> <td align="center">=</td> <td></td> </tr> <tr> <td>_____</td> <td>_____</td> <td>_____</td> </tr> </table>	NUMBER TO PROCURE	ESTIMATED UNIT COST	ESTIMATED TOTAL COST	x	=		_____	_____	_____																								
NUMBER TO PROCURE	ESTIMATED UNIT COST	ESTIMATED TOTAL COST																																
x	=																																	
_____	_____	_____																																
Section B: EXISTING WORKSTATION UPGRADES Memory (512KB required; 640KB recommended) Memory Upgrade 512KB to 640KB Memory Upgrade - 1MB or greater Hard Disk - (20MB or > recommended) Floppy Disk-5.25"/1.2MB DOS Upgrade (3.2 or > recommended) Surge Protector Optional: Mouse (requires 9-pin serial port) 9-pin serial port Color monitor/graphics card Math Co-processor	<table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:33%;"></td> <td style="width:33%;"></td> <td style="width:33%;"></td> </tr> <tr> <td>_____</td> <td>_____</td> <td>_____</td> </tr> </table>				_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
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Section C: PERIPHERALS Printer Tape backup = or > 20MB	<table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:33%;"></td> <td style="width:33%;"></td> <td style="width:33%;"></td> </tr> <tr> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>_____</td> <td>_____</td> <td>_____</td> </tr> </table>				_____	_____	_____	_____	_____	_____																								
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_____	_____	_____																																
Section D: LAN ACCESS Enter total number of workstations that require LAN access.	<table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:33%;"></td> <td style="width:33%;"></td> <td style="width:33%;"></td> </tr> <tr> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>_____</td> <td>_____</td> <td>_____</td> </tr> </table>				_____	_____	_____	_____	_____	_____																								
_____	_____	_____																																
_____	_____	_____																																
Section E: HOST ACCESS - Calculate totals from all workstations. AVAILABLE + PROCURE = TOTAL Host: 1. _____ 2. _____ 3. _____	<table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:33%;"></td> <td style="width:33%;"></td> <td style="width:33%;"></td> </tr> <tr> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>_____</td> <td>_____</td> <td>_____</td> </tr> </table>				_____	_____	_____	_____	_____	_____	_____	_____	_____																					
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Section F: LAN-BASED APPLICATIONS Enable Harvard Graphics Other _____	<table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:33%;"></td> <td style="width:33%;"></td> <td style="width:33%;"></td> </tr> <tr> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>_____</td> <td>_____</td> <td>_____</td> </tr> </table>				_____	_____	_____	_____	_____	_____																								
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_____	_____	_____																																
Section G: ESTIMATED GRAND TOTAL FOR WORKSTATIONS: _____																																		
Section H: ORGANIZATION DESCRIPTION Workstation POC _____ Phone _____ Dept/Location/Bldg _____ Room _____ Additional comments: _____																																		

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WORKSTATION PROCUREMENT SUMMARY INSTRUCTIONS

The Workstation Procurement Summary is provided to assist in the summarization of workstation requirements and estimated cost per LAN. The information recorded on this form will also assist in determining the type and size server required. One Workstation Procurement Summary Form should be completed for each LAN package.

Section A: NEW WORKSTATIONS

This section indicates the total requirement for proposed new workstations. Enter the total number of boxes checked in Section A on all Workstation Requirements Forms. An Estimated Total Cost may be obtained by multiplying the Estimated Unit Cost by the Number to Procure.

Section B: EXISTING WORKSTATION UPGRADES

This section is a compilation of components to be purchased to upgrade existing workstations. The PROCURE column of Section B on the Workstation Requirements Forms should be totaled by component and brought forward to the appropriate space on this form. Calculate the Estimated Total Cost.

Section C: PERIPHERALS

If a requirement for additional workstation peripherals has been determined, bring the totals forward and calculate the Estimated Total Cost.

Section D: LAN ACCESS

LAN access refers to the interface between workstations, the LAN server, and host mainframe computers. Each workstation that is to be connected to the LAN must be counted and totaled. The Estimated Unit Cost reflects the component cost per workstation for the connectivity. Components included in the estimated cost are: one network interface card, cable and connectors, and a workstation portion of the cost of a MSAU/HUB/REPEATER if required.

Section E: HOST ACCESS

Host Access refers to specific communications connections required as determined in Section D of the Workstation Requirements Form. Some workstations require connectivity to more than one host mainframe. Calculate the totals per host mainframe for all workstations that currently have access to mainframes and enter on "AVAILABLE" lines. Calculate the totals for additional connectivity requirements and enter on appropriate "PROCURE" lines.

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For each host, add the "AVAILABLE" and "PROCURE" totals and enter on the "TOTAL" line.

Section F: LAN-BASED APPLICATIONS

If an automation requirement exists for Enable or Harvard Graphics, a LAN compatible version may be procured and installed on the LAN server. This will allow each user access to the application and shared files.

Count the total workstations that require use of each application. Calculate Estimated Total Cost based on user pack information provided for each application and record totals in appropriate spaces.

Section G: ESTIMATED GRAND TOTAL FOR WORKSTATIONS

This total is a sum of the Estimated Total Cost column.

Section H: ORGANIZATION DESCRIPTION

Section H is used to provide information about the requesting organization, the LAN Administrator, and the proposed location.

Additional Comments may be used to record any specific requirements or notes that supplement the information provided on the form.

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SERVER REQUIREMENTS FORM

PAGE: 1 of 2 **DATE: __/__/__**

Section A: Number of workstations supported by this server _____

Section B: STANDARD PROCESSOR		PROCURE	COST PER ITEM	ESTIMATED COST
CPU:				
Intel	80286	_____	_____	_____
	80386	_____	_____	_____
	80486	_____	_____	_____
Banyan CNS (includes Base System software & documentation)				
	80386	_____	_____	_____
	80486	_____	_____	_____

Section C: BASE SYSTEM SOFTWARE & ADD-ON OPTIONS				
(Include cost of documentation)				
Base System:	Vines/286	_____	_____	_____
	Vines/286 to 386 Upgrade	_____	_____	_____
	Vines/386	_____	_____	_____
	Vines/386 TEAM	_____	_____	_____
Options:	Network Mail	_____	_____	_____
	PC Network Print	_____	_____	_____
	PC Dial-In	_____	_____	_____
	S-S LAN	_____	_____	_____
	Token Ring Bridge	_____	_____	_____
	TCP/IP Routing	_____	_____	_____
	TCP/IP S-S	_____	_____	_____
	PC/TCP	_____	_____	_____
	SMTP Mail Gateway	_____	_____	_____
	MacVines Mail	_____	_____	_____
	Asynchronous T.E.	_____	_____	_____
	3270/SNA	_____	_____	_____
	Advanced 3270/SNA	_____	_____	_____
	3270/SNA Graphics	_____	_____	_____
	3270/BSC	_____	_____	_____
	X.29 Software	_____	_____	_____
	X.25 S-S	_____	_____	_____
	S-S WAN	_____	_____	_____
	Vines Toolkit	_____	_____	_____
	Oracle Server	_____	_____	_____
	MacLAN Connect	_____	_____	_____
	Vines SMP	_____	_____	_____

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SERVER REQUIREMENTS FORM

PAGE: 2 of 2	DATE: __/__/__		
Section D: ENHANCEMENTS			
Expansion disk storage	Type		
Serial Port(s)	_____	_____	_____
Parallel Port(s)	_____	_____	_____
Remote workstation:			
Hayes Modem	_____	_____	_____
ICA Card	_____	_____	_____
Other _____	_____	_____	_____
Section E: PERIPHERALS			
Printer - Near Letter Quality	_____	_____	_____
Printer - Laser	_____	_____	_____
Surge protector	_____	_____	_____
Plotter	_____	_____	_____
Other _____	_____	_____	_____
Section F:			
ESTIMATED GRAND TOTAL FOR SERVER:		_____	
Section G: ORGANIZATIONAL DESCRIPTION			
Directorate _____	Dept/Division _____		
LAN Administrator _____	Phone _____		
LAN Building/Location _____			
Additional Comments:			

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SERVER REQUIREMENTS FORM - INSTRUCTIONS

The Server Requirements Form is provided to assist in the collection and summarization of server hardware/software requirements to support the functional requirements of LAN connectivity. Only one copy of this form is required per LAN package.

Categories in the right hand columns indicate characteristics of a given item. The three headings are: Procure, Cost Per Item, and Estimated Cost. Enter an "X" in the "Procure" column if the item will be required. The current rounded cost is listed under the "Cost Per Item" column. Calculate the total cost, if more than one item is required, and record in the "Estimated Cost" column. If an item is not required, leave the "Procure" and "Est Cost" columns blank.

Section A: NUMBER OF WORKSTATIONS

Enter the total number of workstations supported by this server. This number is the total number of Workstation Requirements Forms which have been completed. (One Workstation Requirement Form should have been completed for each workstation.)

Section B: STANDARD PROCESSOR

Check the server required for procurement. The standard processor configuration choice is dependent on the number of workstations to be supported. Workload volume anticipated and acceptable level of performance should also be taken into consideration. Detailed configuration information for each type of server is provided in Chapter 4 of this document.

Section C: SERVER SOFTWARE AND ADD-ON OPTIONS

Select the appropriate VINES Base System software and options required for procurement. The software selected is based on the processor selected. A detailed VINES software matrix for each platform is provided in Chapter 4 of this document.

Section D: ENHANCEMENTS

Enhancements include additional resources that may be needed to service all required applications. A workstation is considered remote if it is physically located in another building. If it requires access to the LAN server and use of shared files, check the items listed under "Remote Workstation".

Section E: PERIPHERALS

Peripherals refer to additional devices required as shared

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resources for users on the LAN to service application requirements. For example, a single laser printer attached to the server can be accessed by the entire group.

Section F: ESTIMATED GRAND TOTAL FOR SERVER

Add all estimated costs and enter the total on this line.

Section G: ORGANIZATION DESCRIPTION

This section is used to provide information about the requesting organization, the LAN Administrator of the server, and the proposed location of the server. Enter information requested in the appropriate blanks.

Additional comments may be used to record any specific requirements or notes that supplement the information provided on the form.

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LOCAL AREA NETWORK REQUIREMENTS SUMMARY FORM

Section A: TOTAL ESTIMATED COSTS			
Proposed Department/ Division	Total Workstation Estimated Cost	Total Server Estimated Cost	Total LAN Estimated Cost
ESTIMATED GRAND TOTAL			

Section B: ORGANIZATION DESCRIPTION

Directorate _____

Point of Contact _____ Phone _____

Additional Comments:

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LOCAL AREA NETWORK REQUIREMENTS SUMMARY FORM - INSTRUCTIONS

Section A: TOTAL ESTIMATED COSTS

The LAN Requirements Summary is provided to assist in the summarization of start-up LAN costs for the Directorate. The information recorded on this form assists in Directorate decisions concerning costs associated with initial implementation of LAN technology. At this stage of LAN planning, a planning package for each LAN should have been prepared. Each planning package should consist of a Workstation Procurement Summary form with associated individual Workstation Requirements forms and a Server Requirements form for each LAN. Estimated costs recorded in this package are used to provide total estimated costs for planned LANs for the Directorate.

For each LAN proposed for the Directorate, record the name of the department/division supported by each LAN in the blank in the left hand column.

In the Total Workstation Estimated Cost column, enter the "ESTIMATED GRAND TOTAL FOR WORKSTATIONS" figure from the Workstation Procurement Summary form associated with that LAN.

In the Total Server Estimated Cost column, enter the "ESTIMATED GRAND TOTAL FOR SERVER" figure from the Server Requirements form associated with that LAN.

In the Total LAN Estimated Cost column, record the sum of the Total Workstation Estimated Cost and the Total Server Estimated Cost.

Record the sum of entries in the Total LAN Estimated Cost beside "ESTIMATED GRAND TOTAL". This figure represents total estimated costs for the Directorate for start-up LAN hardware and software procurement.

Section B: ORGANIZATION DESCRIPTION

Section B is used to provide information about the requesting organization, the LAN Administrator, and the proposed location.

Additional comments may be used to record any specific requirements or notes that supplement the information provided on the form.

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Appendix E

REGIONAL NETWORK SUPPORT REPRESENTATIVES

1. RASC, MCB CAMP FOSTER, OKINAWA. All Marine Corps Organizations, exclusive of reserve sites, recruiting, and FMF organizations which it is currently chartered to provide support for. This includes RJE sites.
2. RASC, MCB CAMP PENDLETON. All Marine Corps Organizations, exclusive of reserve sites, recruiting, and FMF organizations which it is currently chartered to provide support for. This includes RJE sites and the 12th Marine Corps District.
3. RASC, MCB CAMP LEJEUNE. All Marine Corps Organizations, exclusive of reserve sites, recruiting, and FMF organizations which it is currently chartered to provide support for. This includes RJE sites, but not those organizations which will be covered by EDMP (Local Area Network ISMO).
4. MCAB EAST, CHERRY POINT. All Marine Corps SE organizations in the Cherry Point, New River, and Beaufort Bases.
5. RJE, HAWAII. All Marine Corps SE organizations, exclusive of Reserve sites, Recruiting centers, which are geographically located in Hawaii and other activities as directed by the Commandant of the Marine Corps.
6. DCID, QUANTICO VA. All Marine Corps organizations aboard Quantico, exclusive of the CDPA Quantico.
7. I&L, CLARENDON VA. All Clarendon organizations and other Marine Corps organizations in the Washington D.C. area (exclusive of HQMC), to include Henderson Hall and the Marine Corps Barracks at 8th and I.
8. CODE ARI, HQMC. All HQMC staff agencies except I&L.
9. ISMO, I MEF. All FMF organizations within I MEF, exclusive of the First MEB.
10. ISMO, II MEF. All FMF organizations, exclusive of those handled by the FMFLANT ISMO.
11. ISMO, III MEF. All FMF organizations within III MEF.
12. ISMO, 4TH MARDIV/4TH MARINE AIR WING. All Reserve sites and the 8th Marine Corps District.
13. ISMO, 1ST MEB. All of the FMF units within the First MEB.
14. EDMP, MCB CAMP LEJEUNE. Exclusive of RASC Camp Lejeune,

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all Comp Lejeune SE organizations.

15. ISMC, MCTSSA. All of the units of MCTSSA.

16. ISMC, FMELANT. All FMF/SE organizations in the Norfolk and Virginia Beach areas, including those units within FMFEUR.

17. CDPA, KANSAS CITY. All Marine Corps organizations, exclusive of reserve sites, in the Kansas City area, to include the Marine Corps Reserve Support Center, the 9th Marine Corps District, and other activities as directed by the Commandant of the Marine Corps.

18. CDPA, ALBANY GA. All Marine Corps organizations, exclusive of reserve sites, in the Albany, Georgia area. To include the 6th Marine Corps District and any other activities as directed by the Commandant of the Marine Corps.

19. CDPA, QUANTICO, VA. The CDPA, Quantico, and the 1st and 4th Marine Corps District.